TM 11-6720-250-35

TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOL LISTS

PHOTOGRAPHIC SURVEILLANCE SYSTEM, AIRBORNE KS-113A

HEADQUARTERS, DEPARTMENT OF THE ARMY

OCTOBER 1971

WARNING

Be careful when working on the 115-volt ac, 400-Hz, three-phase, line connections and the 28-volt dc equipment connections. Serious injury or death may result from contact with these terminals.

WARNING

HIGH VOLTAGE

is used in this equipment

DEATH ON CONTACT

May result if safety precautions are not observed. Be careful not to contact high voltage capacitors when working inside the Pod Assembly, Flasher LA-338A. If capacitor charge lamps are lit inside LA-388A, discharge the capacitors before proceeding.

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE LA-388A

DON'T TAKE CHANCES!

TECHNICAL MANUAL No. 11-6720-250-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *18 October 1971*

Direct Support, General Support and Depot Maintenance Manual Including Repair Parts and Special Tool Lists

PHOTOGRAPHIC SURVEILLANCE SYSTEM, AIRBORNE KS-113A

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

1-1. Scope

a. This manual covers direct support, general support, and depot maintenance for Photographic Surveillance System, Airborne KS-113A (Camera control system). It includes instructions at direct support, general support, and depot levels of maintenance. It also lists tools, materials, and test equipment authorized for direct and general support and depot maintenance.

b. The complete technical manuals for this equipment are listed in (1) through (5) below.

(1) Organizational Maintenance Manual including Repair Parts and Special Tools List Flasher System Photographic Aircraft LS-59A (TM 11-6760-228-12).

(2) DS, GS and Depot Maintenance Manual Flasher System Photographic Aircraft LS-59A (TM 11-6760-228-35-1).

(3) Operator and Organizational Maintenance Manual Camera, Still Picture KA-76A and Lens Cones, Camera, Aerial Reconnaissance LA-370A, LA-371A, and LA-372A (TM 11-6720-236-12).

(4) DS, GS and Depot Maintenance Manual Camera, Still Picture KA-76A and Lens Cones, Camera, Aerial Reconnaissance LA-370A, LA-371A and LA-372A (TM 11-6720-236-35).

(5) Operator and Organizational Maintenance Manual Photographic Surveillance System Airborne KS-113A (TM 11-6720-250-12).

NOTE

For applicable forms and records, refer to paragraph 1-3, TM 11-6720-250-12.

1-2. Reporting of Equipment Manual Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-ME-NMP-AD, Fort Monmouth, N.J. 07703.

1-3. Common Names and Unit Numbers

The following common names and unit numbers have been assigned to the major components of Photographic Surveillance System, Airborne KS-113A.

Nomenclature	Common name	Unit No.
Photographic Surveillance System, Airborne KS-113A	Camera control system	N/A
Control, Height-Ground Speed Ratio C-8340/A	Manual V/H control panel	7
Panel, Photo Junction (134AV75060-5)	Photo junction panel	8
Control Master, Aircraft LA-432A	Photo control panel	3
Control, Power Supply LA-406A	Photo system assembly	1
Actuator Assembly, Rotary Mount Positioning LA-409A	Rotary mount actuator	2
Actuator-Electro-MECH Linear (3 used)	Left door actuator, Right door actuator, Vertical door actuator	4
Light Sensor, Aircraft Camera LA-407A (3 used)	Left light sensor, Right light sensor, Vertical light sensor.	5
Panel, Camera Pulse (134AV81400-1 or 134AV81400-3)	Camera pulse panel	6
Pod Assembly, Flasher LA-388A	Pod assembly	10
Camera, Still Picture KA-76A	Camera	9
Mount, Aircraft Camera LA-408A	Camera mount A	11
Mount, Aircraft Camera LA-408B	Camera mount B	12
Tracker, Flight Line LA-178A	Flight line tracker	13
Sight, Oblique, Photo (Right) LA-163A	Right oblique sight	14
Sight, Oblique, Photo (Left) LA-162A	Left oblique sight	15

quired to apply the vertical, right oblique or left oblique light sensor (Unit 5) exposure (brightness) signal through the photo junction panel (Unit 8) to the camera (Unit 9). This exposure (brightness) signal drives the camera shutter curtains to the desired slit width opening and also the lens cone diaphragm (except LA-370A, 1 3/4-inch lens cone) to the desired opening (f/stop). Operation of the preselected camera door actuator relay 8K2, 8K3 or 8K4 will inhibit the exposure (brightness) signal of the remaining light sensors from control over the exposure circuitry of the camera (Unit 9).

(5) If desired, the camera (Unit 9) can be tripped manually, when in the pulse or pulse IMC mode, with one exposure made for each depression of the camera pulse switch on the pilot's stick or one depression of the CAMERA pushbutton switch located on the observer's camera pulse panel (Unit 6).

(6) The pilot may make visual observation through the erected flight line tracker (Unit 13) to assure him that the vertically positioned camera (Unit 9) is taking film frame exposures of terrain immediately beneath the aircraft. The pilot may use his left oblique sight (Unit 15) for observation purposes to assure himself that the left oblique positioned camera (Unit 9) is taking film frame exposures of the intended left oblique target area. The observer's right oblique sight (Unit 14) may be used in a similar manner when taking right oblique film frame exposures. Aircraft aerodynamic altitude corrections will assure the pilot of adequate target coverage.

b. *Typical Night Mission* (fig. 2-2). In the typical night photo mission, all major components of the camera control system are used except the three light sensors (Unit 5), flight line tracker (Unit 13), left oblique sight (Unit 15), and right oblique sight (Unit 14). The purely optical flight line tracker, left oblique sight (Unit 15), right oblique sight (Unit 14) and light sensors (Unit 5) cannot effectively be used during night mode operation. Limited use of these major components may be possible during the twilight and dawn hours. Use of pod assembly (Unit 10) artificial lighting to obtain optimum night film frame exposures limits aircraft altitude to a maximum of 2,000 feet above terrain.

(1) A manual E V/H signal, generated by the manual V/H control panel (Unit 7), is routed through the photo junction panel (Unit 8) and photo control panel (Unit 3) and applied to the photo system assembly (Unit 1). The system E V/H signal from the photo system assembly (Unit 1) is applied to the pod assembly (Unit 10). The photo system assembly (Unit 1) operates to develop + and – film drive voltages having a magnitude dependent upon the magnitude of the applied system E V/H signal and tachometer feedback signal from camera (Unit 9). The + and – film drive voltages provide power to the camera film drive motor which drives film at the prescribed rate to effectively compensate for apparent image motion during film frame exposure. In addition, a cycle pulse output signal is also produced that has a pulse repetition rate which is directly dependent upon the magnitude of applied system E V/H. Cycle pulse interval time determines the ultimate rate at which the camera is tripped and film frame coverage percentage of overlap.

(2) A night mode ground signal, generated within the photo control panel (Unit 3), is applied through the photo junction panel (Unit 8) to the night relay 1K4 in photo system assembly (Unit 1). This action causes relay 1K4 to energize, providing the night exposure increase (ground) to the camera (Unit 9). Application of the night exposure increase (ground) signal causes the camera shutter curtains to drive to their fullest open (1/60 second) position.

NOTE

Since only the LA-370A (1 3/4-inch lens cone) is used in the night mode, no variable diaphragm is present.

(3) With the photo control panel (Unit 3) MOUNT switch in the 90° position, +28-volt dc power is routed through the doors ground safety relay 8K1, nose gear up-lock switch S2 to the vertical camera door actuator relay 8K4. Operation of this relay applies +28 volt dc power to the vertical door actuator (Unit 4) which mechanically opens the vertical camera window door. A vertical door actuator limit signal is applied to the photo system assembly (Unit 1). The 90° mount position ground signal utimately results in rotary mount actuator (Unit 2) operation which mechanically positions the rotatable mount to the 90° (vertical) position.

(4) The system E V/H signal from within the photo system assembly (Unit 1) is applied to the pod assembly (Unit 10) to program the illuminator modules and control the illumination intensity level.

NOTE

The pod assembly (Unit 10) contains three separate illuminator modules

NOTES:

1. OPTICAL-MECHANICAL DEVICE, USED ONLY WHEN TAKING VERTICAL PHOTOS.
2. OPTICAL-MECHANICAL DEVICE, USED ONLY WHEN TAKING OBLIQUE PHOTOS.
3. ARBITRARY REF DESIGNATORS HAVE BEEN ASSIGNED TO RELAYS IN PHOTO JCT PNL (UNIT 8).
4. NOSE GEAR UP-LOCK SWITCH S2 AND MANUAL V/H OVERRIDE RELAY K3 ARE FUNCTIONALLY PART OF THE KS-113A AND PHYSICALLY PART OF THE AIRCRAFT.

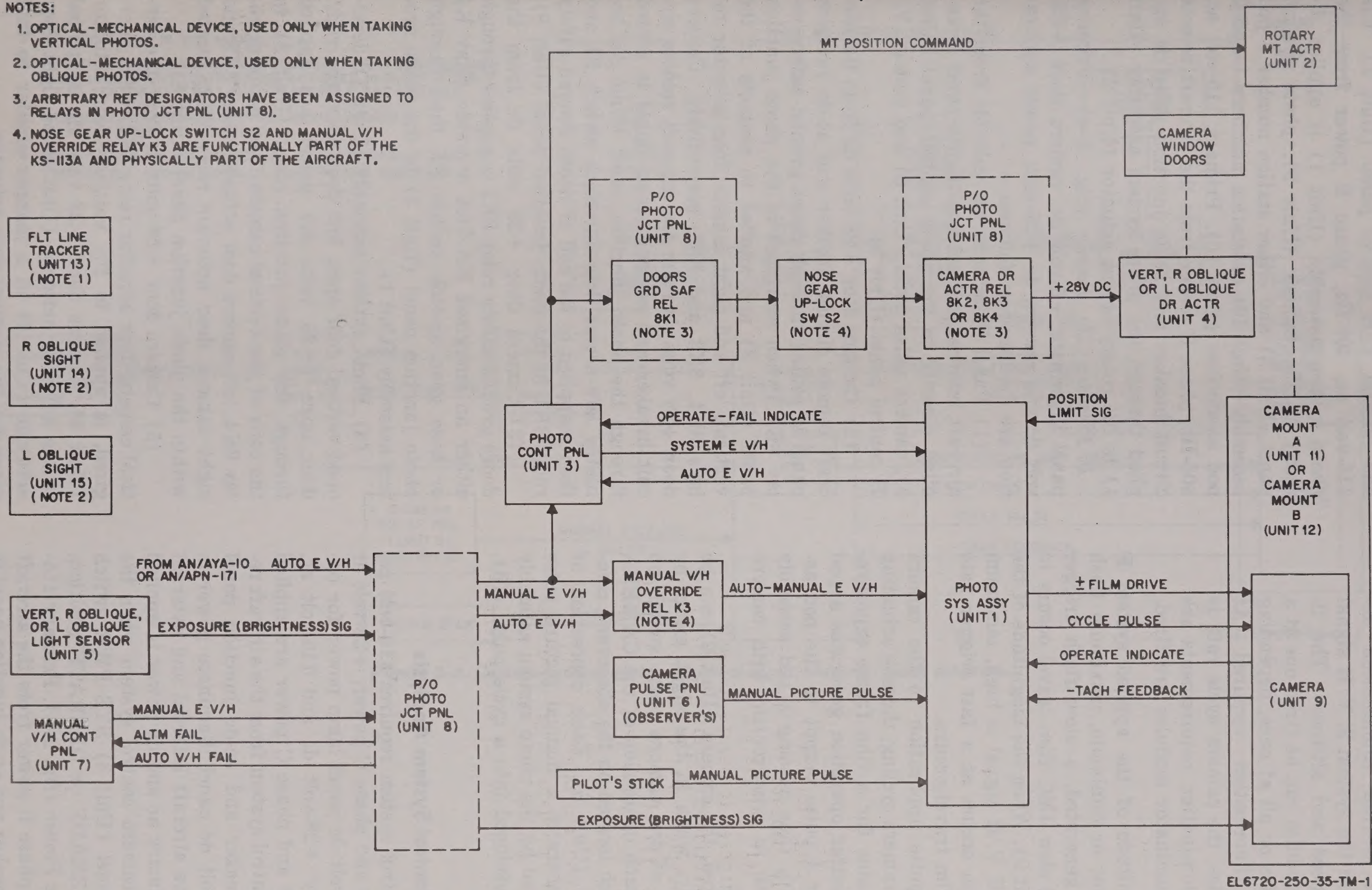


Figure 2–1. Camera control system (typical day mission), block diagram.

which are used to provide variable amounts of terrain illumination depending upon the system E V/H signal (aircraft speed and altitude). The illuminator modules can be fired one at a time, in pairs or all at once, depending upon the illumination required. At high altitudes, the camera cycle rate is slow and illumination requirements are high, all illuminator modules are fired.

When the magnitude of the applied system E V/H signal is low or minimum, maximum flash illumination is generated, a slow flash trigger rate results and slow IMC film travel occurs in the camera (Unit 9). When the magnitude of the applied system E V/H signal is high, minimum flash illumination occurs at a fast trigger rate and fast ICM film travel occurs.

(5) Cycle pulse application to the camera (Unit 9) causes camera cycling, thereby actuating the shutter curtains for a film frame exposure. Each camera shutter operation generates a pod assembly trigger I pulse output to the pod assembly (Unit 10), thus causing a pod assembly illumination flash in synchronism with camera shutter operation.

(6) If desired, the camera (Unit 9) can be tripped manually, when in the night mode, by each depression of the camera pulse switch on pilot's stick or each depression of the CAMERA pushbutton switch located on the observer's camera pulse panel (Unit 6). Each depression of either switch generates a manual picture pulse which is processed by the photo system assembly (Unit 1) and developed into a cycle pulse ((5), above).

2–2. Camera Control System Analysis

The camera control system requires 115-volt ac, 400-Hz, phase B and phase C power, +28-volt dc power and +5-volt dc panel lamp power for operation. Primary +28-volt dc and 115-volt ac, 400-Hz, phase B and phase C power are applied to the camera control system from the aircraft remote circuit breaker and ac-dc junction panel which the +5-volt dc panel illuminate power is received from the aircraft internal and external lights panel. Primary ac and dc power is applied throughout the camera control system when the photo control panel (Unit 3) SYS PWR switch is set to either READY or OPERATE position.

a. Primary Ac Power (fig. 2–3). Primary 115-volt ac, 400-Hz, phase B power from the aircraft remote circuit breaker and ac-dc junction panel is applied to the photo system assembly (Unit 1) and manual V/H control panel (Unit 7). The 115-volt ac, 400-Hz, phase B power from the photo system assembly (Unit 1) is applied directly to the camera (Unit 9), photo control panel (Unit 3) and either station number 5 pod assembly (Unit 10) or station numbers 1 and 2 pod assemblies (Unit 10). Primary 115-volt ac, 400-Hz, phase C power from the aircraft remote circuit breaker and ac-dc junction panel is applied through the photo system assembly (Unit 1) to the rotary mount actuator (Unit 2).

b. Primary Dc Power (fig. 2–4). Primary panel illuminate +5-volt dc, camera door +28-volt dc and camera dc +28-volts power application are discussed as follows:

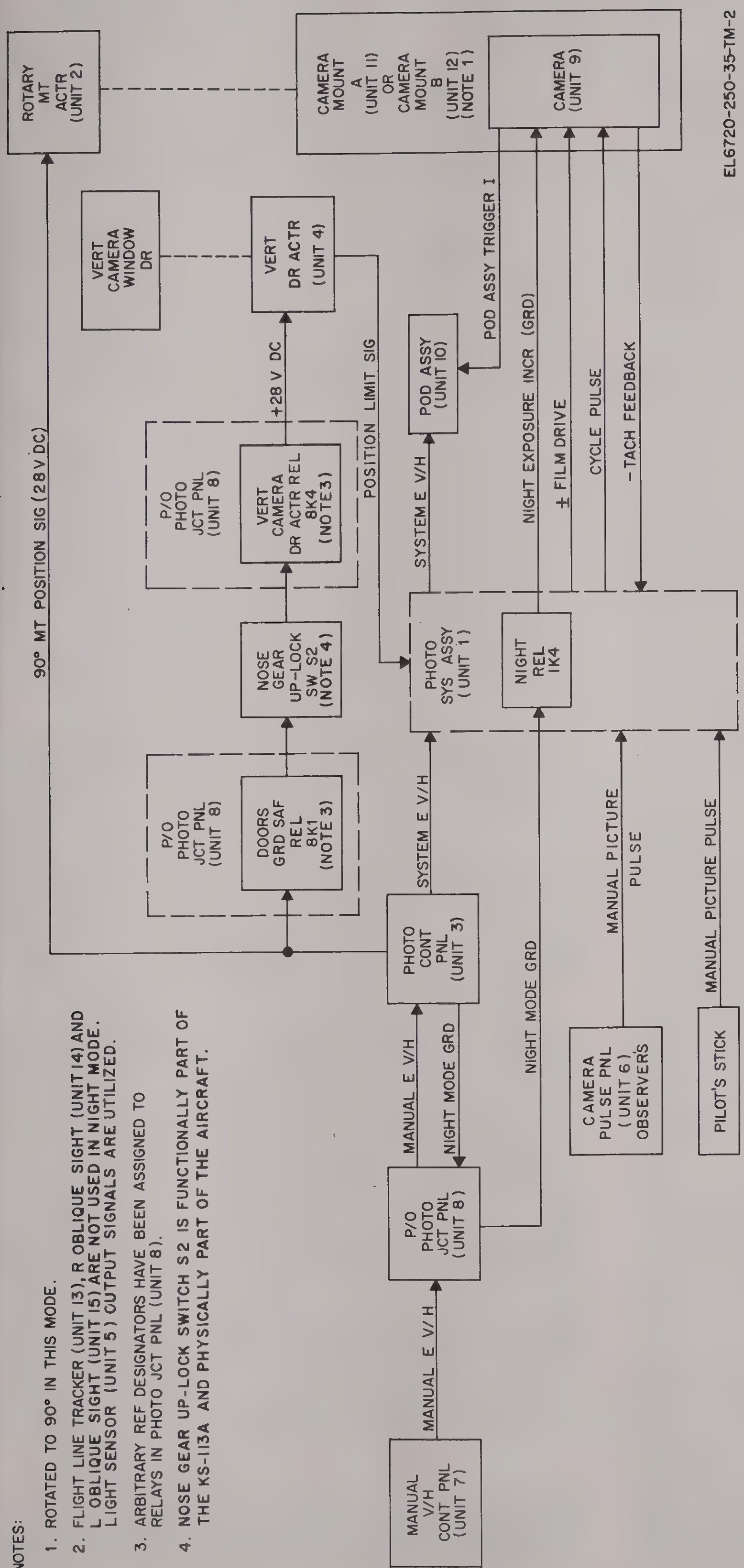
(1) Panel illuminate +5 volts dc from the aircraft internal and external lights panel is applied directly to the photo control panel (Unit 3), camera pulse panel (Unit 6) and manual V/H control panel (Unit 7).

(2) Camera door +28 volts dc from the aircraft remote circuit breaker and ac-dc junction panel is routed through doors ground safety relay 8K1 (when energized in the photo junction panel (Unit 8) and applied to contacts at the vertical, left and right camera door actuator relays 8K4, 8K3 and 8K2 respectively. Camera door +28 volts dc from the aircraft remote circuit breaker and ac-dc junction panel is routed through the photo junction panel (Unit 8), actuated left access door interlock switch S1 and then reapplied to the coil of doors ground safety relay 8K1 in the photo junction panel (Unit 8).

(3) Camera door +28 volts dc from the doors ground safety relay 8K1 is applied through either an energized KA–76A override relay K4 or nose gear up-lock switch S2, then through photo junction panel (Unit 8) to the photo system assembly (Unit 1).

(4) Photo system assembly (Unit 1) developed vertical door open, left door open and right door open (+28 volts dc) power are applied through the photo junction panel (Unit 8) to the coils of the vertical camera door actuator relay 8K4, left camera door actuator relay 8K3 and right camera door actuator relay 8K2, located within the photo junction panel (Unit 8).

(5) Camera door +28 volts dc from the vertical camera door actuator relay 8K4, when energized, is applied to the vertical door actuator (Unit 4). Camera door +28 volts dc is applied to the left door actuator (Unit 4) or right door actuator (Unit 4) in a manner similar to that given for the vertical door actuator.



NOTES:

1. ROTATED TO 90° IN THIS MODE.
2. FLIGHT LINE TRACKER (UNIT 13), R OBLIQUE SIGHT (UNIT 14) AND L OBLIQUE SIGHT (UNIT 15) ARE NOT USED IN NIGHT MODE. LIGHT SENSOR (UNIT 5) OUTPUT SIGNALS ARE UTILIZED.
3. ARBITRARY REF DESIGNATORS HAVE BEEN ASSIGNED TO RELAYS IN PHOTO JCT PNL (UNIT 8).
4. NOSE GEAR UP-LOCK SWITCH S2 IS FUNCTIONALLY PART OF THE KS-113A AND PHYSICALLY PART OF THE AIRCRAFT.

Figure 2-2. Camera control system (typical night mission), block diagram.

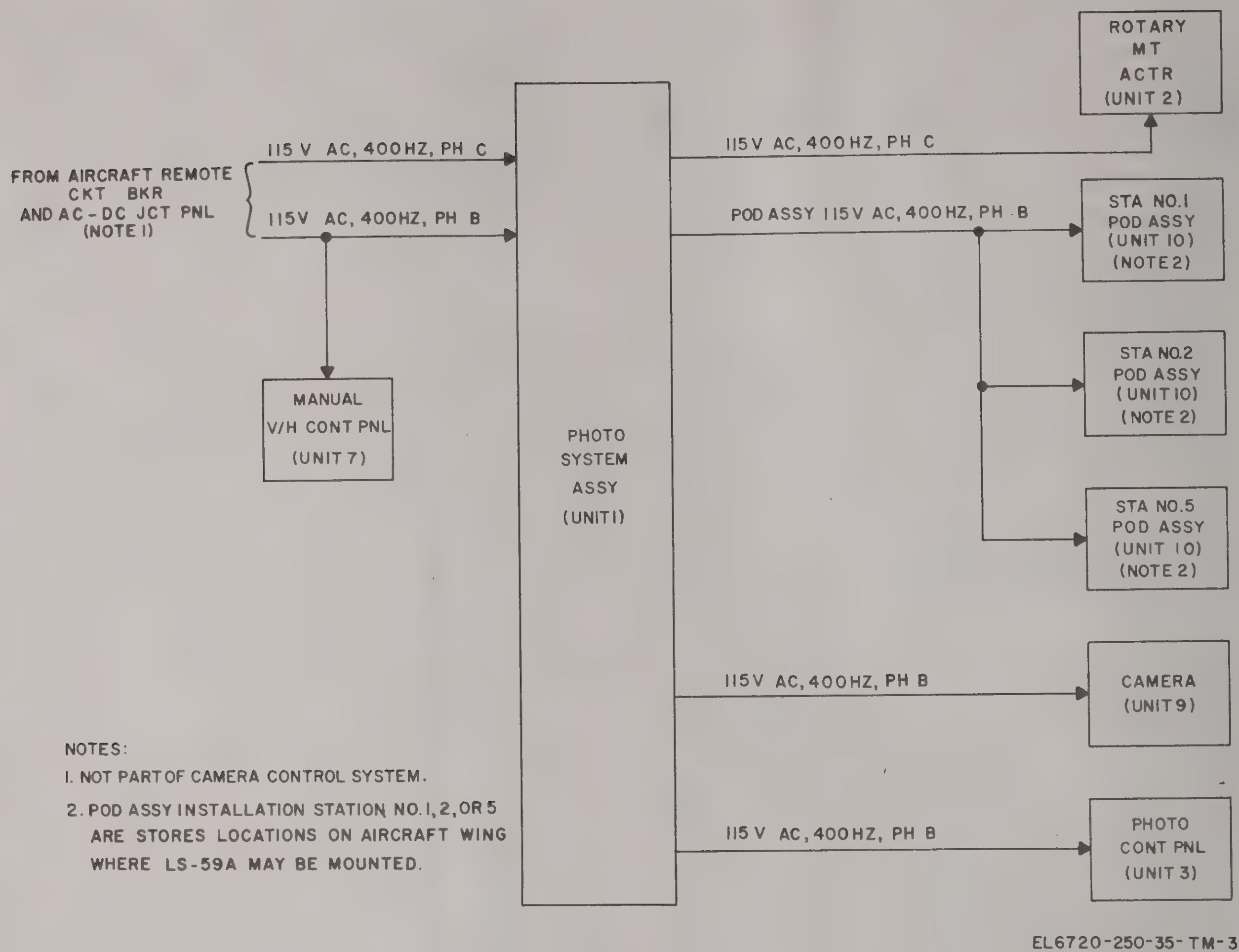


Figure 2-3. Primary ac power circuit, block diagram.

(6) Camera dc +28 volts from the aircraft remote circuit breaker and ac-dc junction panel is routed through the photo junction panel (Unit 8) and applied to the manual V/H control panel (Unit 7), photo control panel (Unit 3) and photo system assembly (Unit 1).

(7) The +28-volt dc camera power from the photo system assembly (Unit 1) is applied through photo junction panel (Unit 8) to the coil windings of camera pulse relay K2 and KA-76A override relay K4. The +28-volt dc camera power from the photo junction panel (Unit 8) is also applied to the camera (Unit 9) and aft junction panel.

(8) A data request common (+28 volts dc) from the aft junction panel, is applied through the photo system assembly (Unit 1) to the camera (Unit 9).

(9) Pod assembly +28 volts dc from the photo system assembly (Unit 1) is applied through the photo junction panel (Unit 8) to station number 1, 2 or 5 for pod assembly (Unit 10) operation, dependent on aircraft configuration.

(10) When actuated, the gear down override switch S3 applies a ground through the photo junction panel (Unit 8) to the coil winding of KA-76A override relay K4 which energizes and is held energized through its own contacts.

(11) When the MODE switch 3S3 in the photo control panel (Unit 3) is in either the PULSE or PULSE IMC position, a pulse mode ground signal is applied through the photo junction panel (Unit 8) to camera pulse relay K2 and photo system assembly (Unit 1). The pulse mode ground signal from the photo system assembly (Unit 1) is applied to the camera (Unit 9).

Figure 2-4. Primary dc power circuit, block diagram.
[Located in back of manual]

c. Exposure Servo Loop (fig. 2-5). The exposure servo loop circuitry provides the exposure control necessary to adjust the camera shutter speed and the LA-371A (3-inch lens cone),

LA-374A (6-inch lens cone) or LA-372 (12-inch lens cone) aperture iris diaphragm when operating the camera control system in any mode except night. The complete exposure servo control circuit is comprised of the left, right and vertical light sensor (Unit 5), photo junction panel (Unit 8) and camera (Unit 9). Each light sensor (Unit 5) generates a continuous exposure (brightness) signal which is applied to the photo junction panel (Unit 8). Selection of the MOUNT switch 3S2 on photo control panel (Unit 3) ((1), (2) or (3) below determines which light sensor exposure (brightness) signal is routed through the photo junction panel (Unit 8) and applied to the camera (Unit 3). Refer to TM 11-6720-236-35 for the exposure servo loop discussion within the camera (Unit 9).

(1) With the MOUNT switch 3S2 on photo control panel (Unit 3) in R15° or R30° position, right door open (+28 volts dc) is applied to right camera door actuator relay 8K2 in photo junction panel (Unit 8), energizing the relay. This action applies the exposure (brightness) signal from the right light sensor (Unit 5) through the right camera door actuator relay 8K2 in photo junction panel (Unit 8) to the camera (Unit 9).

(2) With the MOUNT switch 3S2 on photo control panel (Unit 3) in 90° (vertical) position, vertical door open (+28 volts dc) is applied to vertical camera door actuator relay 8K4 in photo junction panel (Unit 8), energizing the relay. This action applies the exposure (brightness) signal from the vertical light sensor (Unit 5) through the vertical camera door actuator relay 8K4 in photo junction panel (Unit 8) to the camera (Unit 9).

(3) With the MOUNT switch 3S2 on the photo control panel (Unit 3) in L15° or L30° position, left door open (+28 volts dc) is applied to left camera door actuator relay 8K3 in photo junction panel (Unit 8) energizing the relay. This action applies the exposure (brightness) signal from the left light sensor (Unit 5) through the left camera door actuator relay 8K3 in photo junction panel (Unit 8) to the camera (Unit 9).

d. Film Drive Servo Loop (fig. 2-6). The film drive servo loop circuitry provides the image motion compensation (IMC) and forward overlap either automatically ((1) below) or manually ((2) below).

(1) *Automatic.*

(*a*) Auto E V/H dc analog signal, developed by either the Airborne Data Annotation System AN/AYA-10 or Airborne Radar Navigation Air System AN/APN-171, is applied through the photo junction panel (Unit 8) to the manual V/H override relay K3.

(*b*) With manual V/H override relay K3 energized, the automatic E V/H signal is applied through the photo junction panel (Unit 8), photo system assembly (Unit 1) to the photo control panel (Unit 3).

(*c*) With the V/H switch 3S1 on photo control panel (Unit 3) in the AUTO position, the auto E V/H signal is applied through the switch as system E V/H signal to the printed circuit board and component assembly module 1A3 within the photo system assembly (Unit 1). The printed circuit board and component assembly module 1A3 produces the compensated E V/H signals.

(*d*) With both -tachometer feedback signal from camera (Unit 9) and compensated E V/H signal from the printed circuit board and component assembly module 1A3 applied the film drive amplifier module 1A2 produces the + and - film drive voltages which are supplied to the camera (Unit 9). The magnitude of the generated output drive voltages is dependent upon the magnitude of the applied -tachometer feedback and system E V/H input signals.

(2) *Manual.*

(*a*) Manual E V/H dc analog voltage, manually controlled and developed within the manual V/H control panel (Unit 7), is routed through the photo junction panel (Unit 8) and simultaneously applied to the manual V/H override relay K3 and the photo control panel (Unit 3).

(*b*) With the V/H switch 3S1 on photo control panel (Unit 3) in the MANUAL position, manual E V/H is routed through the V/H switch 3S1 and is designated system E V/H signal.

(*c*) The system E V/H signal from the photo control panel (Unit 3) is processed in the same manner as the auto E V/H signal ((1)(*c*) and (*d*) above).

(*d*) If the automatic E V/H signal is lost, manual V/H override relay K3 is deenergized, the manual E V/H signal is routed through the manual V/H override relay K3, photo junction panel (Unit 8) and photo system assembly (Unit 1) and applied to the photo control panel (Unit 3) even if the V/H switch 3S1 is in the AUTO position. The system E V/H signal from the photo control panel (Unit 3) is processed in the same manner as the auto E V/H signal ((1) (*c*) and (*d*) above).

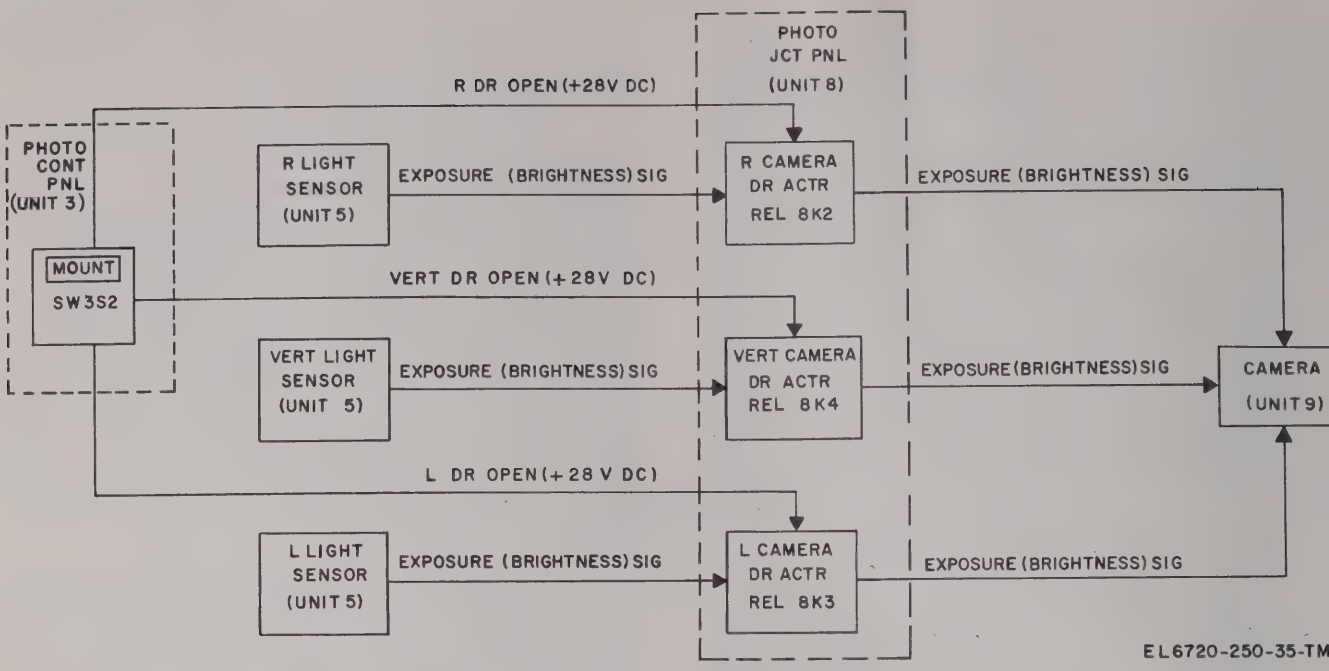


Figure 2–5. Exposure servo loop, block diagram.

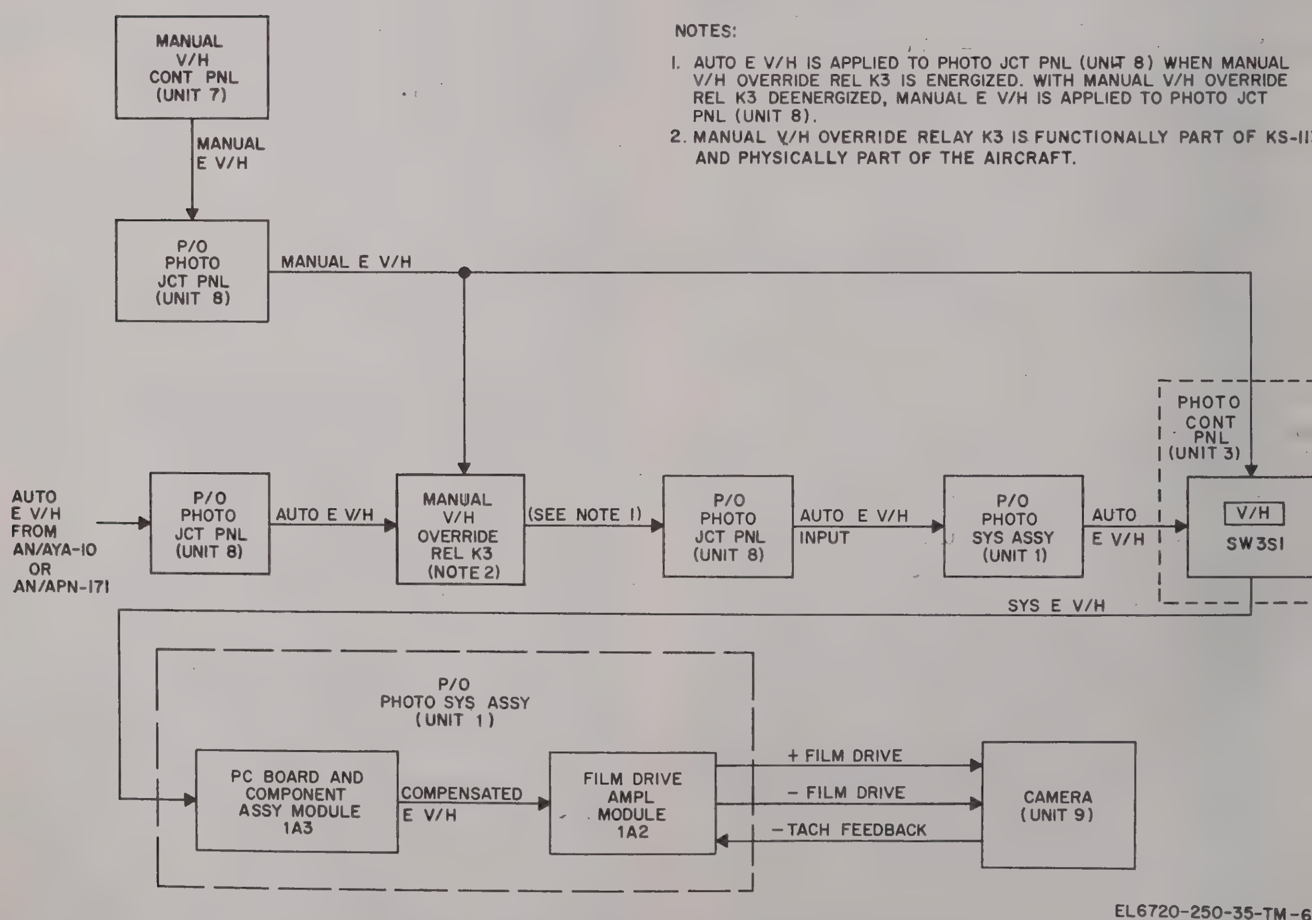


Figure 2–6. Film drive servo loop, block diagram.

e. Night Control Circuits (fig. 2-7). Manual E V/H signal, manually controlled and generated at the manual V/H control panel (Unit 7), is applied through the photo junction panel (Unit 8) to the photo control panel (Unit 3). This signal is converted to a system E V/H signal. The system E V/H signal is then applied through the photo system assembly (Unit 1) to the pod assembly (Unit 10).

(1) With the MODE switch 3S3 on photo control panel (Unit 3) in NIGHT position, a night mode ground signal is applied through the photo junction panel (Unit 8) to the photo system assembly (Unit 1). The photo system assembly (Unit 1) processes this night mode ground signal to develop a night exposure increase (ground) signal which is applied to the camera (Unit 9). Application of this ground signal causes the camera shutter curtains to be driven to their widest opening and slowest shutter speed (1/60 second) position.

(2) The pod assembly trigger I pulses and system E V/H signal, from the photo system assembly (Unit 1), are constantly applied to the pod assembly (Unit 10) in all modes of operation. When night mode ground is applied, the photo system assembly (Unit 1) completes the required circuitry to apply pod assembly +28 volts dc (system energized) and pod assembly 115-volt ac, 400-Hz, phase B power to the pod assembly (Unit 10). When the +28-volt dc pod interlock circuitry is functioning normally, pod assembly ready (+28 volts dc) power is applied to the photo system assembly (Unit 1) which functions to supply a ready indicate (+28 volts dc) signal to the photo control panel (Unit 3).

(3) The system E V/H signal, from the photo control panel (Unit 3), is applied to the photo system assembly (Unit 1) which generates + and – film drive voltages and cycle pulse output signal. The + and – film drive voltage determines the amount of ICM, while the cycle pulse trips the camera shutter thereby initiating film frame exposure. As the shutter curtains travel over the film format area, the camera (Unit 9) generates a pod assembly trigger I output which is applied through the photo system assembly (Unit 1) to the pod assembly (Unit 10). Application of the pod assembly trigger I pulse causes the pod assembly (Unit 10) to create a flash burst in synchronization with shutter operation.

f. Camera Mount Positioning Circuit (fig. 2-8). The camera mount positioning circuits are contained in the photo control panel (Unit 3), photo junction panel (Unit 8), photo system assembly (Unit 1), and rotary mount actuator (Unit 2). The camera mount A (Unit 11) or camera mount B (Unit 12) (with camera secured inside) is mechanically connected to the rotary mount actuator (Unit 2). With 115 volts ac, 400 Hz, phase C power applied to the photo system assembly (Unit 1), and camera dc (+28 volts) power applied through photo junction panel (Unit 8) to the photo system assembly (Unit 1), the camera mount position circuit will function in the following manner:

(1) The camera dc +28-volt power is applied to the photo system assembly (Unit 1) and allows passage of the mount position voltage (error signal) through the photo system assembly (Unit 1).

(2) The camera mount 115-volt ac, 400-Hz, phase C power from the photo system assembly (Unit 1) is applied to the rotary mount actuator (Unit 2) as mount 115 volts ac, 400 Hz.

NOTE

Vertical window is used with LA370A (1 3/4 inch) lens cone.

(3) When the LA-370A (1 3/4 inch) lens cone is installed, the camera mount 115 volts ac, 400 Hz, phase C is removed from the rotary mount actuator (Unit 2). However, a power input ground is applied through the normally-open contacts of the left access door interlock switch S4, photo junction panel (Unit 8) to the rotary mount actuator (Unit 2).

(4) When a different mount position is selected with the MOUNT switch 3S2 on the photo control panel (Unit 3), the selected mount command signal is applied through the photo junction panel (Unit 8) to the photo system assembly (Unit 1), as the selected mount switch position signal. This action applies the mount position voltage (error signal) from the rotary mount actuator (Unit 2) through the photo system assembly (Unit 1), photo junction panel (Unit 8), as the mount position (error) signal, back to the rotary mount actuator (Unit 2). The rotary mount actuator (Unit 2) electronics processes the mount position (error) signal and applies the necessary corrective signal to the rotary mount actuator (Unit 2) drive motor to cause the motor to drive the camera mount A (Unit 11) or camera mount B (Unit 12) to the selected position.

g. Camera Window Door Circuit (fig. 2-9). The three camera window door circuits are identical, therefore the following description is applicable to all circuits (left, vertical, and right).

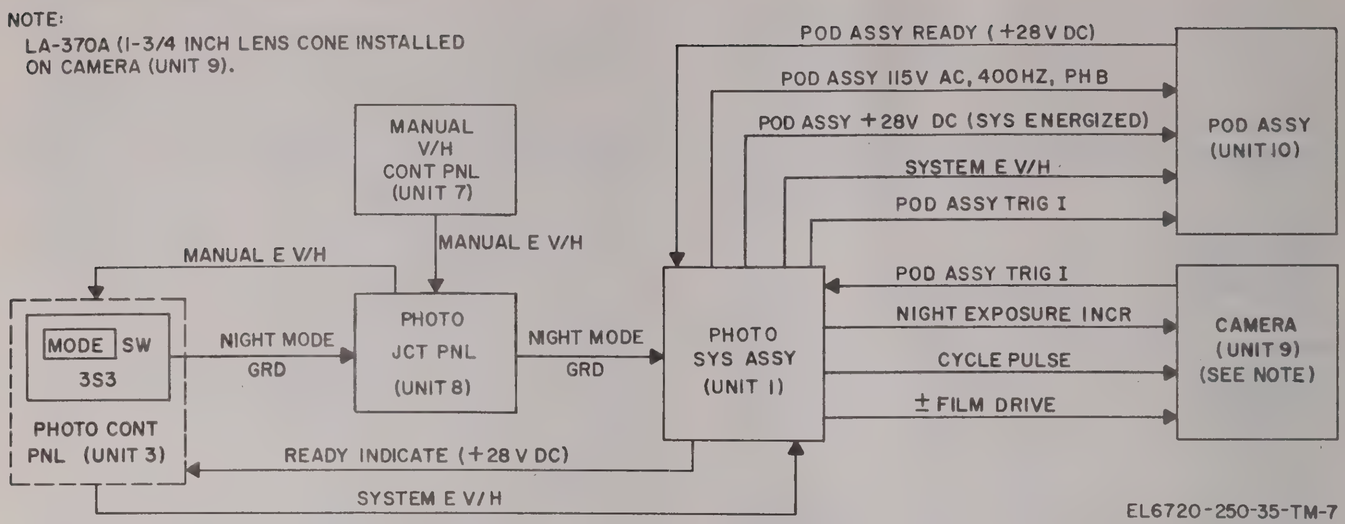


Figure 2–7. Night control circuitry, block diagram.

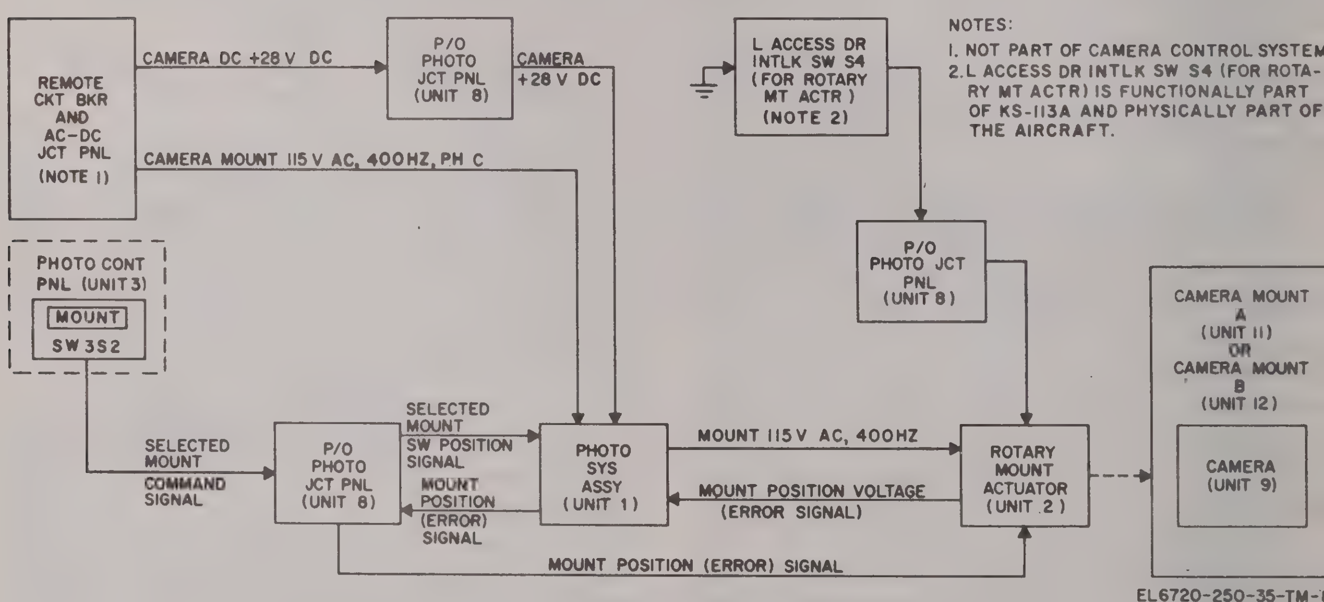


Figure 2–8. Camera mount positioning circuits, block diagram.

The camera window door circuits are operated by +28 volts dc from the aircraft remote circuit breaker and junction panel when the system power switch is in READY or OPERATE position. Camera window doors are opened and closed in the following manner:

(1) Selecting the camera position with the MOUNT switch 3S2 on the photo control panel (Unit 3) enables the selected mount command signal to be applied through the photo junction panel (Unit 8) to the photo system assembly (Unit 1), thereby energizing the selected relay (30° left relay 1A3K8, 30° right relay 1A3K9, 15° left relay 1A3K10 or 15° right relay 1A3K-11). This action allows the camera dc (+28 volts) power to be applied through the photo junction panel (Unit 8) to the photo system assembly (Unit 1) as camera +28 volts dc. The doors open power from the photo junction panel (Unit 8) is now applied through the photo system assembly (Unit 1) as left, right or vertical door open power, to the selected door actuator (Unit 4).

(2) The camera door +28 volts dc is applied through the photo junction panel (Unit 8) to the left access door interlock switch S1 (the

left access door must be closed or the left access door interlock switch S1 manually overridden in order to enable +28 volts dc through this switch). From the left access door interlock switch S1, the +28 volts dc is applied to and energizes the doors ground safety relay 8K1. This switches the +28 volts dc through the photo junction panel and applies +28 volts dc to the nose gear up-lock switch S2 and the KA-76A override relay K4. Closing either nose gear up-lock switch S2 or gear down override switch S3 allows the camera door +28-volt dc power to be applied through the photo junction panel (Unit 8) as doors open power to the photo system assembly (Unit 1). Left, right or vertical door open power is applied from the photo system assembly (Unit 1) to left, right or vertical camera door actuator relays 8K2, 8K3, or 8K4 in the photo junction panel (Unit 8). Door close or open power is then applied to the door actuator (Unit 4).

(3) The window door actuators either extend (close door) or retract (open door) depending on which door circuit (left, right, or vertical) is receiving the door open power. When a particular camera window door receives door open power, the remaining doors (if open) will be automatically closed.

h. Monitoring Circuits (fig. 2-10). The photo control panel (Unit 3) and manual V/H control panel (Unit 7) provide visual indications of camera control system operation. Camera control system monitoring circuits are the ready circuit ((1) below), the operate and frames remaining circuits ((2) below), and the auto fail circuit ((3) below).

(1) *Ready circuit.* The ready circuit functions as follows:

(*a*) When ready ground from the photo control panel (Unit 3) is applied to the photo system assembly (Unit 1), +28-volt dc camera power is applied to the camera (Unit 9).

(*b*) When the film cassettes are properly installed and film is appropriately threaded through the camera (Unit 9), camera interlock (+28 volts dc) power is applied to the photo system (Unit 1).

(*c*) After the preselected left, right or vertical door actuator (Unit 4) has opened its camera door and the rotary mount actuator (Unit

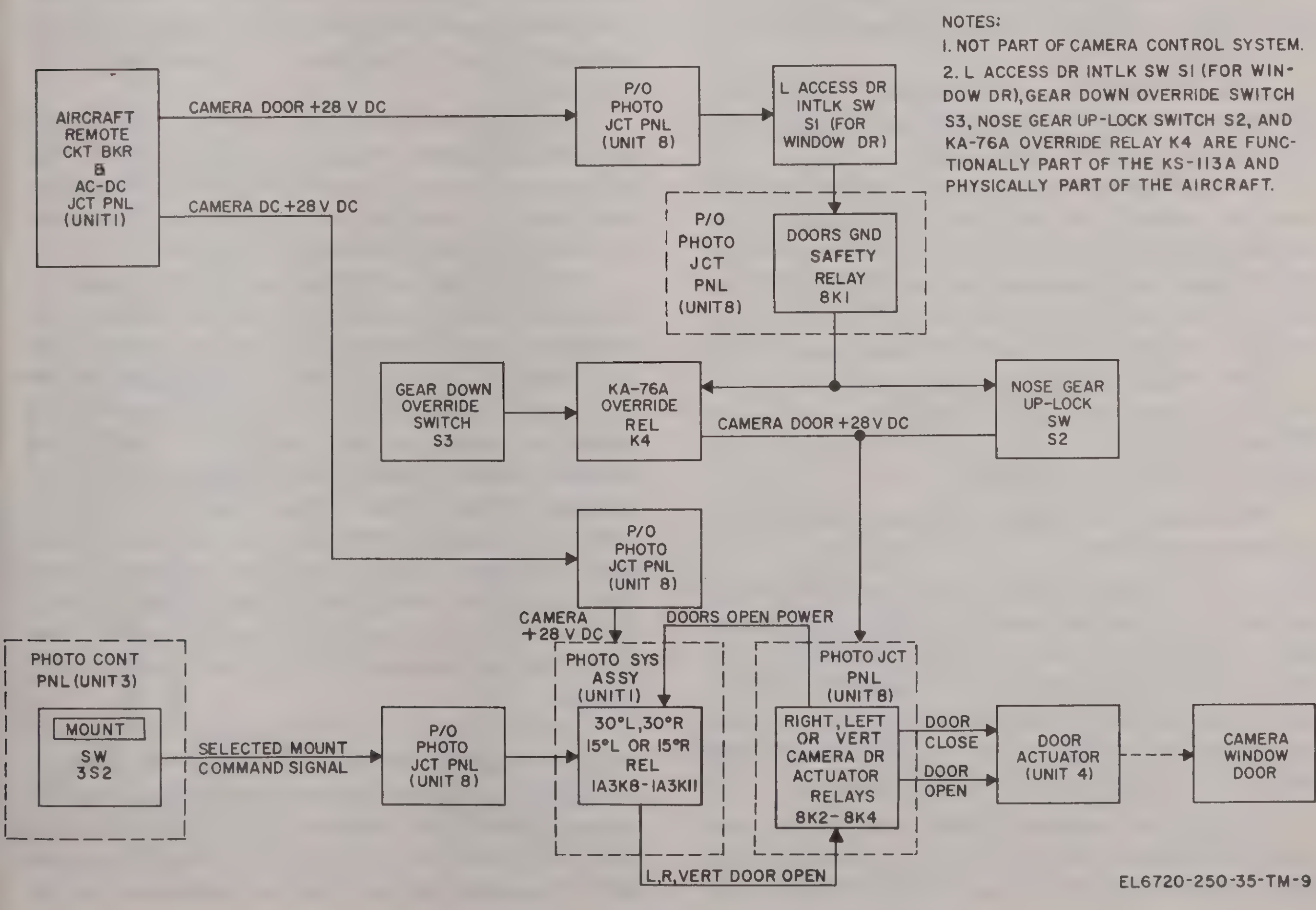


Figure 2-9. Camera window door circuits, block diagram.

2) and mount have been properly positioned, a mount ready ground from rotary mount actuator (Unit 2) is applied to the photo system assembly (Unit 1).

(*d*) With the camera door open, a door open ground signal is routed through the photo junction panel (Unit 8) and applied as a doors open interlock (ground) to the photo system assembly (Unit 1).

(*e*) With ready ground, mount ready ground, camera interlock (+28 volts dc) applied to the photo system assembly (Unit 1), preselected camera door open and the rotary mount actuator (Unit 2) appropriately positioned, the photo system assembly (Unit 1) generates a ready indicate (+28 volts dc) signal to the photo control panel (Unit 3), thereby causing the READY indicator 3DS2 to light.

NOTE

During night mode operation the pod assembly (Unit 10) ready signal must also be applied to the photo system assembly (Unit 1) for the READY indicator 3DS2 in photo control panel (Unit 3) to light.

(2) *Operate and frames remaining circuit.* The operate and frames remaining circuits function as follows:

(*a*) When the camera shutter is tripped, the camera (Unit 9) develops an operate indicate (+28 volts dc) output pulse.

(*b*) The camera operate indicate (+28 volts dc) pulse is routed through the photo system assembly (Unit 1) and applied as an operate-fail indicate simultaneously to the OPERATE indicator 3DS1 and FRAMES REMAINING counter 3M1 located in the photo control panel (Unit 3). Each camera trip operation causes the OPERATE indicator 3DS1 to flash and the FRAMES REMAINING counter 3M1 to decrease its count by one digit.

(3) *Auto fail circuit.* The auto fail circuit functions as follows:

(*a*) Altimeter fail control relay K1 and manual V/H override relay K3 process Airborne Data Annotation System AN/AYA-10 and Airborne Radar Navigation Air System AN/APN-171 generated output signals and applies a control signal to the logic circuit 7A5A2 within the manual V/H control panel (Unit 7).

(*b*) Logic circuit 7A5A2, located in manual V/H control panel (Unit 7), operation applies a pulsed signal to the AUTO FAIL indicator causing it to flash. Manually depressing the AUTO FAIL indicator cover 7S3, resets the logic circuitry 7A5A2 thereby causing the indicator to remain continuously lit at a reduced intensity. The AUTO FAIL indicator remains lit until primary power is removed or until normal Airborne Data Annotation System AN/AYA-10 and Airborne Radar Navigation Aid System AN/APN-171 input signals are applied again.

2-3. Mechanical Functions

a. Rotary Mount Actuator (Unit 2) (fig. 2-11). The rotary mount actuator mechanism consists basically of a gear train with a 430 to 1 ratio, a gear driven potentiometer 2R3, a gear driven limit switch 2S1, and a pinion gear at the output end. The entire mechanism is driven by electric motor 2B1 (para 2-6*e*). The gear motion functions, from helical gear 1 to the output at the pinion gear, as follows:

(1) With helical gear 1 rotating in a CW direction (as viewed from the shaft end of motor 2B1), helical gear 2 rotates as shown, transmitting its rotational force through the helical gear 2 shaft to gear 1. Gear 1 causes gear 2 and gear 3 to rotate as shown. Gear 2 and 3 output shaft transmits its rotational force to the pinion gear. This pinion gear engages a sector gear which is secured to the aft bulkhead of the camera compartment.

(2) As gear 3 rotates, it drives a no spring anti-backlash gear which is secured to the shaft of five turn potentiometer 2R3. Five revolutions are required to drive the wiper arm of potentiometer 2R3 from one stop to the other.

(3) As the no spring antibacklash gear on the shaft of 2R3 rotates, it drives another antibacklash gear in the direction as shown. This antibacklash gear is secured to the shaft of five turn limit switch 2S1. Five revolutions are required to rotate the limit switch 2S1 shaft from one open switch position to the other open switch position. These open switch positions are provided to remove power from motor 2B1. These limit switches open when the camera mount reaches its maximum right or maximum left position so as to prevent the camera mount from being driven beyond its maximum mechanical position.

b. Door Actuator (Unit 4) (fig. 2-12). The actuator shaft assembly of the door actuator (Unit 4) is attached to the left, right, or vertical camera door. With application of +28 volts dc to the door close field winding of the drive motor 4B1, the gears in the door actuator mechanism

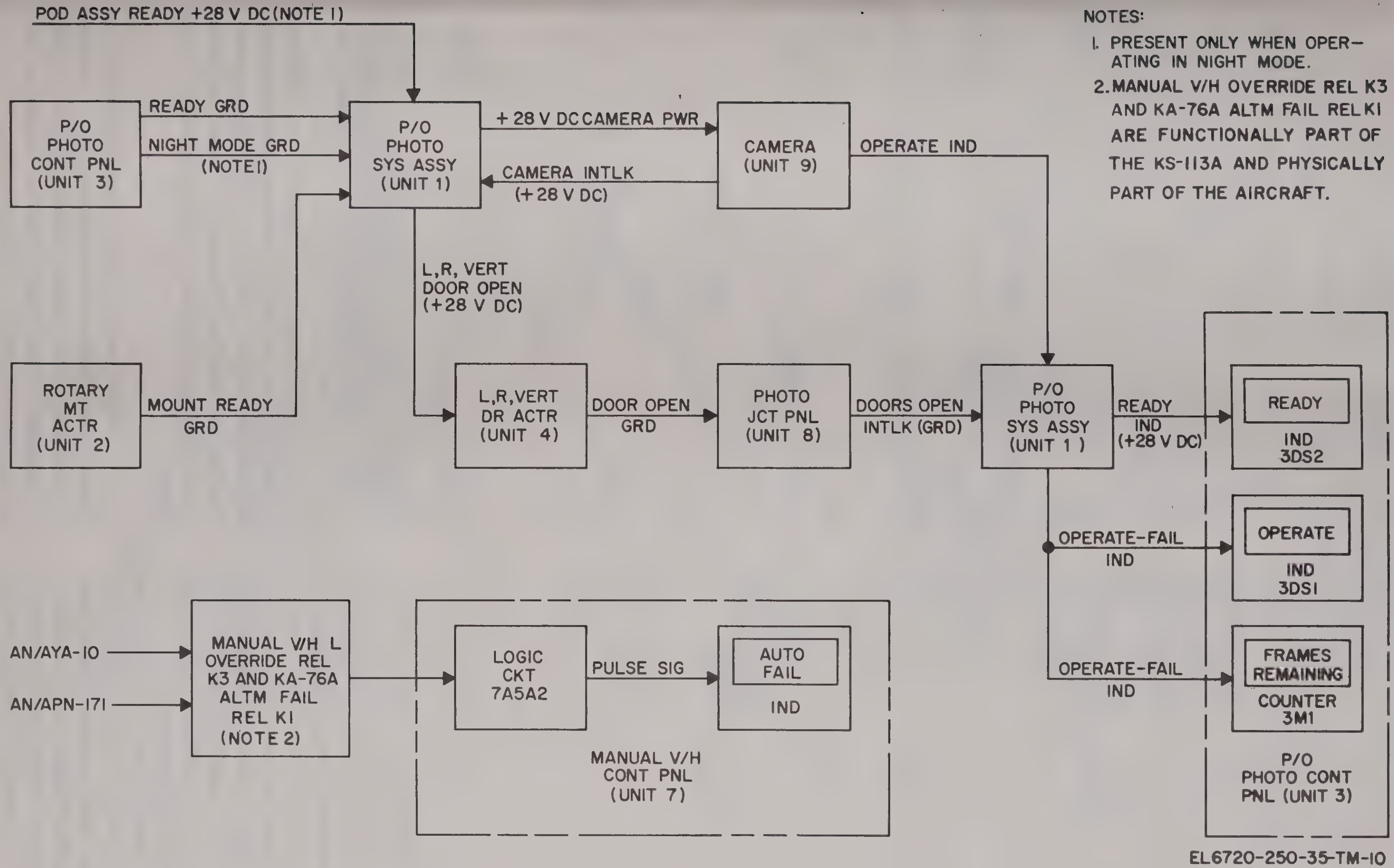


Figure 2–10. Monitoring circuits, block diagram.

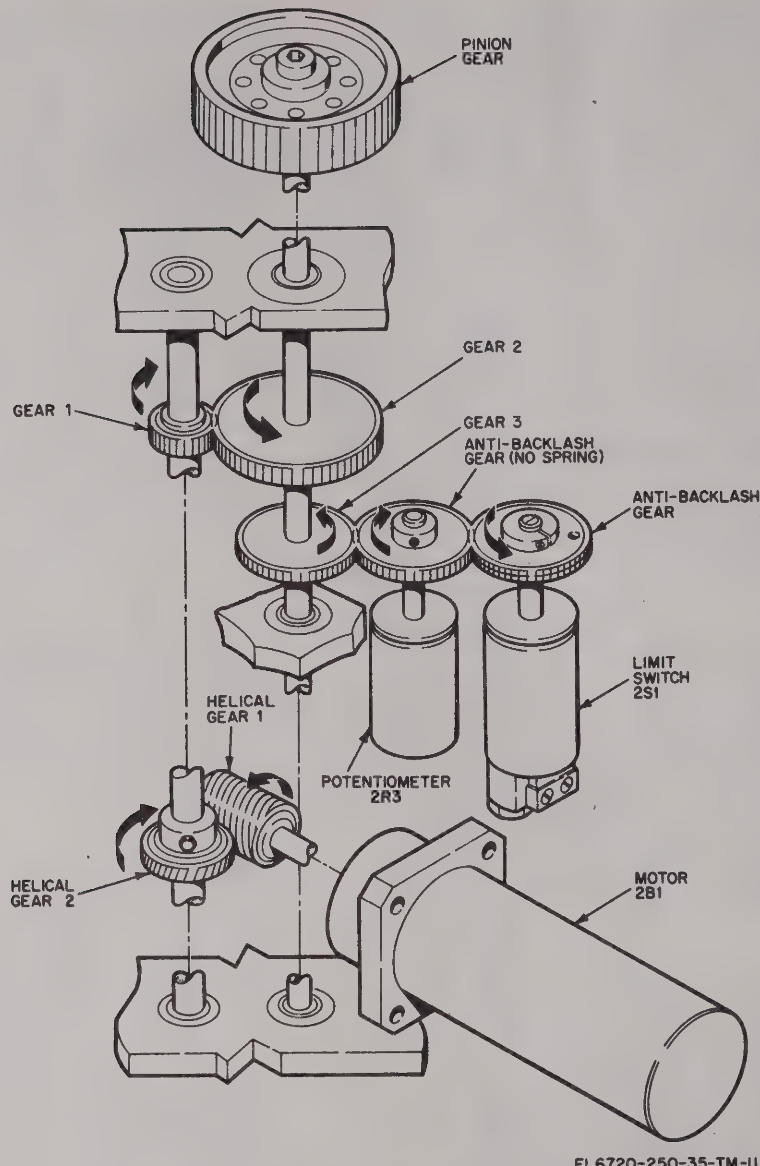


Figure 2-11. Rotary mount actuator mechanisms.

rotate as shown in figure 2-12. This rotation causes extension of the actuator shaft assembly to open the door. With +28 volts dc applied to the door open field winding, the gears rotate in the opposite direction to retract the actuator shaft assembly and close the door. When a limit switch is opened, power is removed from drive motor 4B1, stopping the action of the actuator shaft assembly. The door actuator mechanism functions in the following manner:

(1) The splined end of the drive motor engages a train of spur gears (1, 2 and 3) causing them to rotate in the direction shown. Spur gear (3) has engaged on the right side, through a flange clutch, the driving mechanism for retracting or extending the actuator shaft assembly. Spur gear (3) has engaged on the left side through a worm gear, the driving mechanism for actuating three limit switches (4S2 through 4S4).

(2) Spur gear (3) transmits the rotational force through the flange clutch and bearing shaft to the acme screw. The acme screw rotates causing the actuator shaft assembly (consisting of the acme nut, nut tube and fitting assembly) to retract.

(3) Spur gear (3) also transmits the rotational force to the worm gear which is secured to the end of the bearing shaft. The worm gear is engaged to four traveler screws which are engaged to four switch actuator guides.

NOTE

Three switch actuator guides are used with limit switches 4S2 through 4S4. A fourth switch actuator guide is supplied as a spare.

As the worm gear rotates it causes all the traveler screws to rotate. The traveler screws cause the switch actuator guides to move up or down depending on the direction of rotation of the drive motor 4B1. As the switch actuator guides move they apply force to the limit switch actuators, causing the limit switches 4S2 through 4S4 to open and close in the following manner. When the actuator shaft assembly is fully extended, limit switch 4S2 will open, limit switch 4S3 will close, and limit switch 4S4 will open. Refer to paragraph 2–6*f* for electrical operation of door actuator.

c. Camera (Unit 9). Refer to TM 11-6720-236-35 for mechanical functioning of camera.

2–4. Optical Functions

a. Right Oblique Sight (Unit 14). The right oblique sight provides the observer with a visual determination of the terrain objects passing the axes of the camera in the 15° right or 30° right position. The right oblique sight does not show the camera's field of coverage but it does indicate the central areas of the fields by means of concentric rings. The concentric rings are formed by light passing through bi-fringent material and polarized glass which causes optical interference that results in concentric rings.

(1) The right oblique sight has a depression angle scale that is calibrated at 0, 15, and 30 degrees. This permits aligning the sight with the optical axis of the camera in the 15° right or 30° right position.

(2) During automatic camera operation, aircraft flight is controlled so the image of a point or object to be photographed passes through the

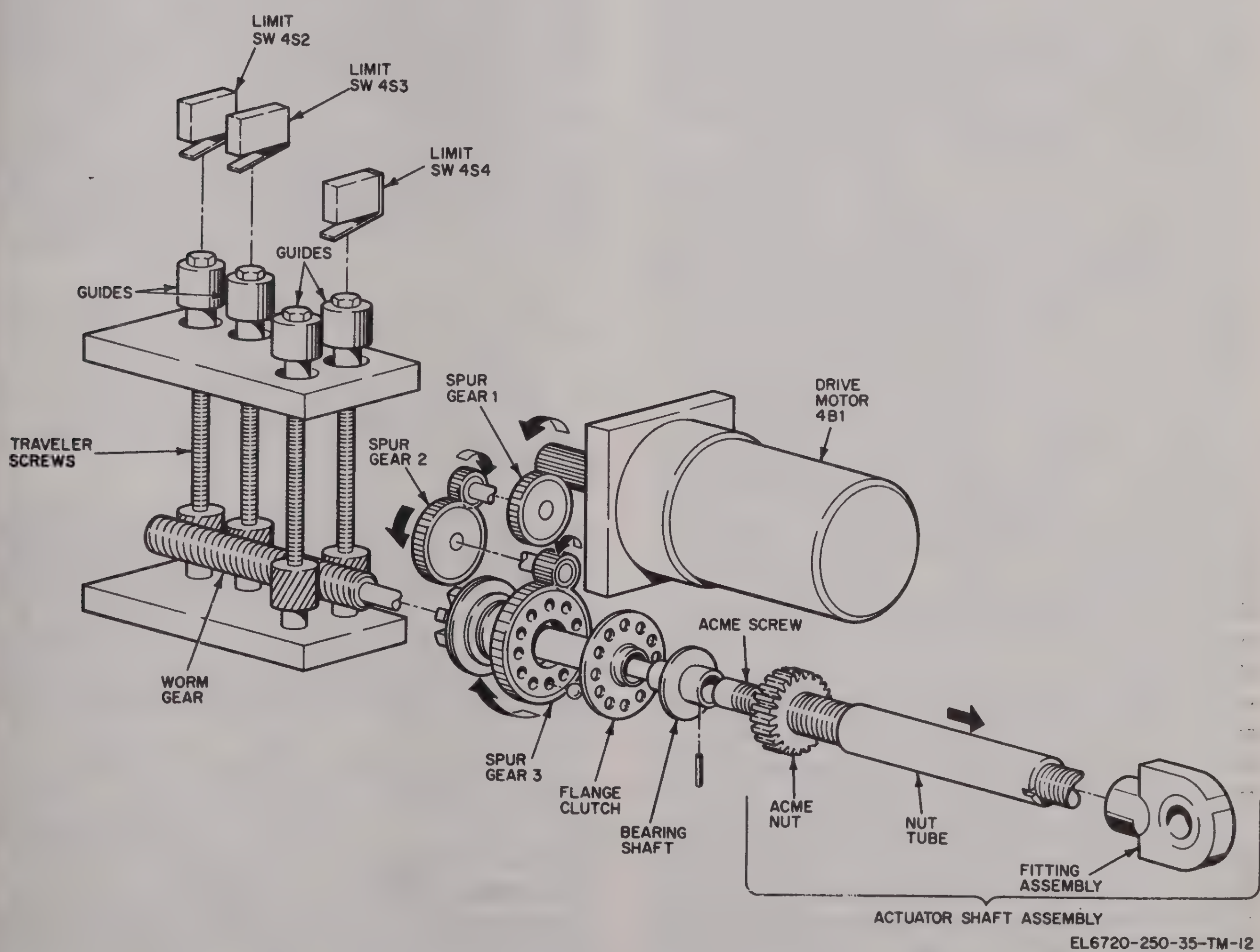


Figure 2–12. Door actuator mechanisms.

approximate center of the sight lens ring pattern. For manual operation, the appropriate camera switch is actuated when the object to be photographed is centered within this pattern.

b. Left Oblique Sight (Unit 15). The left oblique sight is identical in all respects to the right oblique sight (*a* above), except that it is oriented to operate in conjunction with the camera in the 15° left or 30° left position, and is used by the pilot.

c. Camera (Unit 9). Refer to TM 11-6720-236-35 for optical functioning of camera.

2-5. Modes of Operation

The mode of operation for a particular mission is determined prior to the flight because of the inaccessibility (in flight) of various major components of the camera control system. Preflight mode selection is made at the camera (Unit 9). Four operational modes are available; they are autocycle (*a* below) and pulse (*b* below) and pulse IMC (*c* below) for day operation, and night electronic flash (*d* below) for night operation. In all modes of operation, a 60 percent exposure forward overlap of vertical exposures is made for an accurate scale, exsured coverage, and stereoscopic viewing of the photographs.

a. Autocycle Mode (fig. 2-13). The autocycle mode of operation is obtained by setting the mode selector switch on camera (Unit 9) to AUTO REMOTE, the MODE switch 3S3 on photo control panel (Unit 3) to AUTO, V/H switch 3S1 on photo control panel (Unit 3) to either AUTO or MANUAL dependent upon desired E V/H input, SYS PWR switch 3S4 on photo control panel (Unit 3) to READY, POWER switch 7S1 on manual V/H control panel (Unit 7) to ON, OVERRIDE switch 7S2 on manual V/H control panel (Unit 7) to appropriate AUTO or MANUAL position, and VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels on manual V/H control panel (Unit 7) adjusted as required by mission flight requirements.

(1) *Film transport.* In the autocycle mode of operation, the camera shutter is tripped automatically at a rate dependent upon measured film travel. Film moves through the camera (Unit 9) at the IMC rate during exposure and during the interval between exposures. During the recycle period, the film is transported at a greatly increased rate. In this operational mode, a 60 percent overlap of vertical exposures is automatically provided.

(2) *Power and control circuits.* Primary power application circuits (para 2-2*a* and *b*), camera mount positioning circuits (para 2-2*f*), camera window doors circuits (para 2-2*g*), exposure control circuits (para 2-2*c*) and monitoring circuits (para 2-2*h*) are used during this mode of operation.

(3) *Initiate circuits.* Autocycle mode of operation is initiated by setting the SYS PWR switch 3S4 on photo control panel (Unit 3) to OPERATE position. This action applies operate ground through the photo system assembly (Unit 1) to the camera (Unit 9).

(4) *Image motion compensation (E V/H signal).* Image motion compensation (IMC) depends directly on Airborne Data Annotation System AN/AYA-10 or Airborne Radar Navigation Aid System AN/APN-171 externally generated auto E V/H signal or manual V/H control panel (Unit 7) generated manual E V/H signal, camera mount depression angle and focal length of installed lens cone. The IMC rate (speed at which film is moved) is determined by the magnitude of the applied auto E V/H or manual E V/H signal as described in subparagraph (5) and (6) below.

(5) *Image motion compensation (auto E V/H signal).* The image motion compensation (IMC) rate as determined by the use of externally generated auto E V/H signal is as follows:

NOTE

The AN/AYA-10 processes inertial information (V/H) in digital form to analog. The AN/AYA-10 and AN/APN-171 energize or deenergize the manual V/H override relay K3 with reliable or fail outputs.

(*a*) Airborne Data Annotation System AN/AYA-10 and Airborne Radar Navigation Aid System AN/APN-171 externally generated auto E V/H signal is applied through the V/H switch 3S1 (AUTO position) on photo control panel (Unit 3), designated system E V/H, and then applied to the photo system assembly (Unit 1).

(*b*) A mount position command signal from the MOUNT switch 3S2 on photo control panel (Unit 3) is applied to the photo system assembly (Unit 1). A camera lens cone focal length ground signal is also applied to the photo system assembly (Unit 1). These signals control internal circuitry which compensates the applied system E V/H signal for the camera depression

angle and also focal length of the lens cone installed on the camera (Unit 9).

(*c*) The film drive amplifier module 1A2 within the photo system assembly (Unit 1) processes the internally compensated system E V/H signal to establish the ± film drive (IMC) control voltages. The + and – film drive voltage is applied to the camera (Unit 9) film drive circuits which transport film at the correct IMC rate. The camera (Unit 9) generates the –tachometer feedback (IMC) signal which is applied to the film drive amplifier module 1A2 within the photo system assembly (Unit 1) to maintain the correct value of IMC control signal voltage.

(6) *Image motion compensation (manual E V/H signal).* The image motion compensation rate using a manual E V/H signal is established as follows:

(*a*) The VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels on manual V/H control panel (Unit 7) are manually adjusted to indicate aircraft altitude and velocity (obtained from aircraft instruments). The ALTITUDE-FEET and VELOCITY-KNOTS thumbwheels adjust the output voltage such that it is directly representative of aircraft altitude and velocity. Generated manual E V/H signal is routed through the V/H switch 3S1 (MANUAL position) on photo control panel (Unit 3), designated system E V/H and applied to the photo system assembly (Unit 1).

(*b*) The IMC rate is then established as described in *a*(5)(*c*) (above).

b. Pulse Mode (fig. 2–14). Camera control system pulse mode operation is obtained by setting the mode selector switch on camera (Unit 9) to AUTO REMOTE, the MODE switch 3S3 on photo control panel (Unit 3) to PULSE, V/H switch 3S1 on photo control panel (Unit 3) to either AUTO or MANUAL dependent upon desired E V/H input, SYS PWR switch 3S4 on photo control panel (Unit 3) to READY, POWER switch 7S1 on manual V/H control panel (Unit 7) to ON, OVERRIDE switch 7S2 on manual V/H control panel (Unit 7) to appropriate AUTO or MANUAL position, and VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels on manual V/H control panel (Unit 7) adjusted as required by mission flight requirements.

(1) *Film transport.* In the pulse mode of operation, exposures are taken at regular intervals controlled by cycle pulses from the intervalometer module 1A1 within the photo system assembly (Unit 1). For each cycle pulse generated by the intervalometer module 1A1 within the photo system assembly (Unit 1) and applied to the camera (Unit 9), one film frame exposure is made and then the camera automatically recycles. Film remains stationary until the next input cycle pulse actuates the camera (Unit 9). A 60 percent overlap of vertical exposures is provided by the intervalometer module 1A1.

(2) *Power and control circuits.* Primary power application circuits (para 2–2*a* and *b*) camera mount positioning circuits (para 2–2*f*), camera window doors circuits (para 2–2*g*), exposure control circuits (para 2–2*c*) and monitoring circuits (para 2–2*b*) are used during this mode of operation.

(3) *Initiate circuits.* Pulse mode ground from the MODE switch 3S3 (PULSE position) on the photo control panel (Unit 3) is applied to the camera pulse relay K2 and the photo system assembly (Unit 1). Pulse mode operation is initiated by setting the SYS PWR switch 3S4 on photo control panel (Unit 3) to the OPERATE position. This action applies operate ground to the intervalometer module 1A1 within the photo system assembly (Unit 1) and also to the pulse mode selection circuits within the camera (Unit 9). The intervalometer module 1A1 develops a cycle pulse which is applied to the camera (Unit 9).

(4) *Interval between exposures.* The interval between exposures depends directly on the magnitude of the system E V/H signal applied to the photo system assembly (Unit 1). The interval between exposures is established by the use of auto E V/H signal ((*a*) below) or manual E V/H signal ((*b*) below).

(*a*) *Interval between exposures (auto E V/H signal).* Airborne Data Annotation System AN/AYA–10 or Airborne Radar Navigation Aid System AN/APN–171 generated auto E V/H signal is routed through the V/H switch 3S1 (AUTO position) on photo control panel (Unit 3), designated system E V/H, and applied to the intervalometer module 1A1 within photo system assembly (Unit 1). Application of a mount position command and lens cone focal length ground signals to the photo system assembly (Unit 1) causes compensation of the applied system E V/H signal for mount depression angle and focal length of the installed lens cone. The intervalometer module 1A1 processes the compensated E V/H signal to produce a cycle pulse output signal having a pulse interval time duration directly dependent on the magnitude of the compensated E V/H signal.

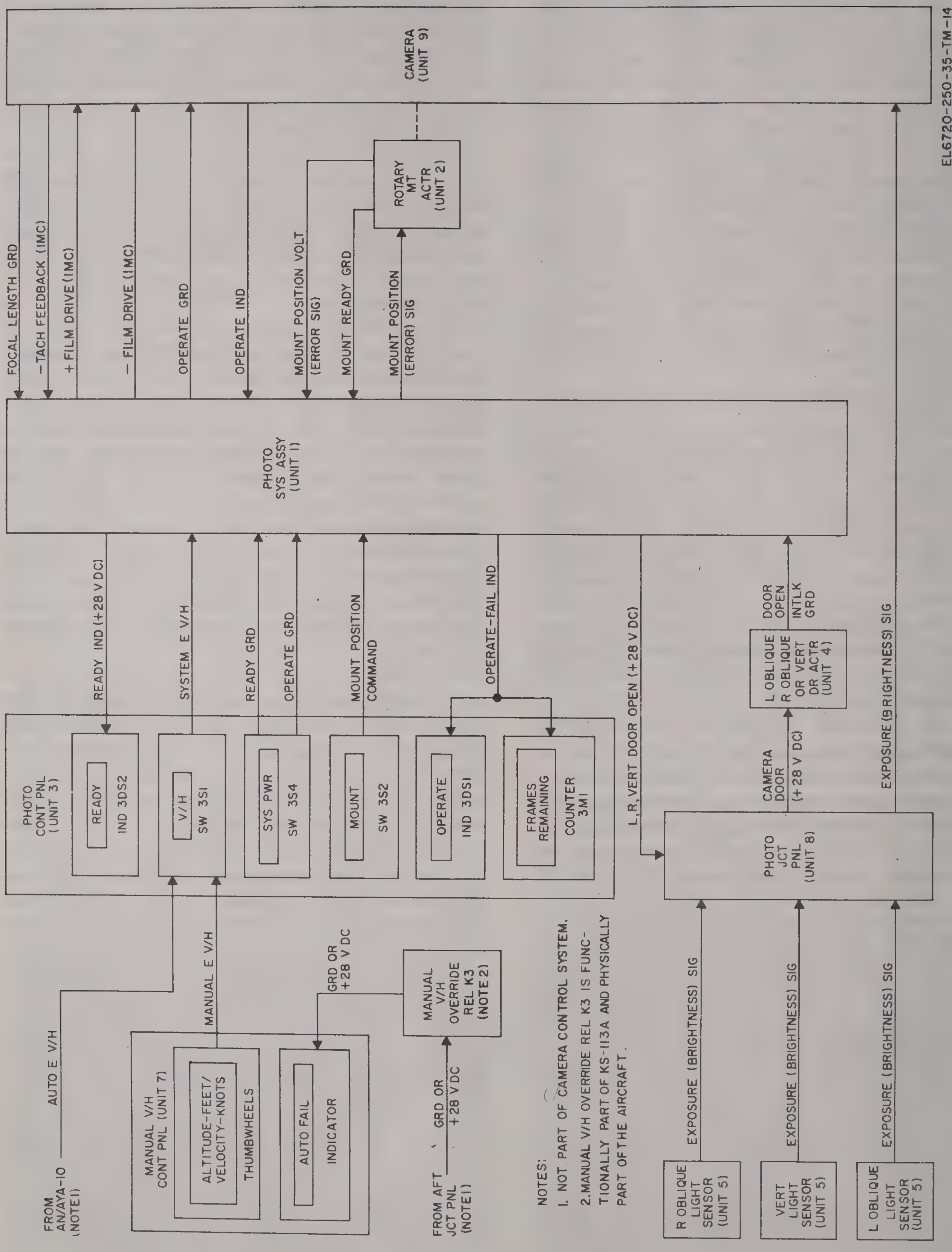


Figure 2-13. Autocycle mode, block diagram.

(b) *Interval between exposures (manual E V/H signal).* The ALTITUDE-FEET and VELOCITY-KNOTS thumbwheels on manual V/H control panel (Unit 7) are manually adjusted to indicate the aircraft altitude and velocity (obtained from aircraft instruments). The ALTITUDE-FEET and VELOCITY-KNOTS thumbwheels adjust the output voltage such that it is directly representative of aircraft altitude and velocity. Generated manual V/H signal is routed through the V/H switch 3S1 (MANUAL position) on photo control panel (Unit 3), designated system E V/H signal and applied to the photo system assembly (Unit 1). The cycle pulse output signal of the intervalometer module 1A1 is applied to the camera (Unit 9).

(5) *Single exposures.* Single film frame exposures are made by momentarily pressing either the CAMERA pushbutton switch 6S1 on camera pulse panel (Unit 6) or the camera pulse switch on the pilot's stick. Pressing either of these switches applies a manual picture pulse (ground) through the photo junction panel (Unit 8) to the photo system assembly (Unit 1), thereby energizing the manual picture relay 1K7 in the photo system assembly (Unit 1). With the relay energized, a cycle pulse is applied to the camera (Unit 9). Holding either of these switches depressed causes the camera (Unit 9) to operate at its maximum cycling rate. In the pulse mode of operation, the camera pulse switch on the pilot's stick overrides the normal interval between exposures established by the intervalometer module 1A1 within photo system assembly (Unit 1). Releasing the pressed switch restores camera (Unit 9) operation to the normal interval between exposures.

c. Pulse IMC Mode (fig. 2–15). Camera control system pulse IMC mode operation is obtained by setting the mode selector switch 9A1A-3S1 on camera (Unit 9) to AUTO REMOTE, the MODE switch 3S3 on photo control panel (Unit 3) to PULSE IMC, V/H switch 3S1 on photo control panel (Unit 3) to either AUTO or MANUAL dependent upon desired E V/H input, SYS PWR switch 3S4 on photo control panel (Unit 3) to READY, POWER switch 7S1 on manual V/H control panel (Unit 7) to ON, OVERRIDE switch 7S2 on manual V/H control panel (Unit 7) to appropriate AUTO or MANUAL position, and ALTITUDE-FEET and VELOCITY-KNOTS thumbwheels on manual V/H control panel (Unit 7) adjusted as required by mission flight requirements.

(1) *Film transport.* In pulse IMC mode of operation, exposures are taken at regular intervals and controlled by cycle pulses from the intervalometer module 1A1 within the photo system assembly (Unit 1) and film is transported through the camera (Unit 9) at an IMC rate. For each cycle pulse received by the camera (Unit 9) from the intervalometer module 1A1, one exposure is made and then the camera automatically recycles. A 60 percent overlap of vertical exposures is provided by the intervalometer module 1A1. Film moves through the camera (Unit 9) during the film frame exposure and also during the time interval (recycle period) between exposures. During the recycle period, film is transported at a greatly increased speed.

(2) *Power and control circuits.* Primary power application circuits (para 2–2*a* and *b*), camera mount positioning circuits (para 2–2*f*), camera window doors circuits (para 2–2*g*), exposure control circuits (para 2–2*c*) and monitoring circuits (para 2–2*h*) are used during this mode of operation.

(3) *Initiate circuits.* The pulse IMC mode of operation is initiated by setting the SYS PWR switch 3S4 on the photo control panel (Unit 3) to the OPERATE position. This action applies operate ground to the intervalometer module 1A1 within the photo system assembly (Unit 1) and also to the pulse IMC mode selection circuits within the camera (Unit 9). The intervalometer module 1A1 develops a cycle pulse which is applied to the camera (Unit 9).

(*a*) *Interval between exposures.* The interval between exposures is established as discussed in *b*(4) above.

(*b*) *Image motion compensation.* Image motion compensation is established as discussed in *a*(4) above.

(*c*) *Single exposures.* Single exposures are taken as discussed in *b*(5) above.

d. Night Mode (fig. 2–16). Camera control system night mode operation (night electronic flash) is obtained by setting the mode selector switch on camera (Unit 9) to AUTO REMOTE, the MODE switch 3S3 on photo control panel (Unit 3) to NIGHT, V/H switch 3S1 on photo control panel (Unit 3) to MANUAL, SYS PWR switch 3S4 on photo control panel (Unit 3) to READY, POWER switch 7S1 on manual V/H control panel (Unit 7) to ON, OVERRIDE switch 7S2 on manual V/H control panel (Unit 7) to MANUAL position and ALTITUDE-FEET and VELOCITY-KNOTS thumbwheels on

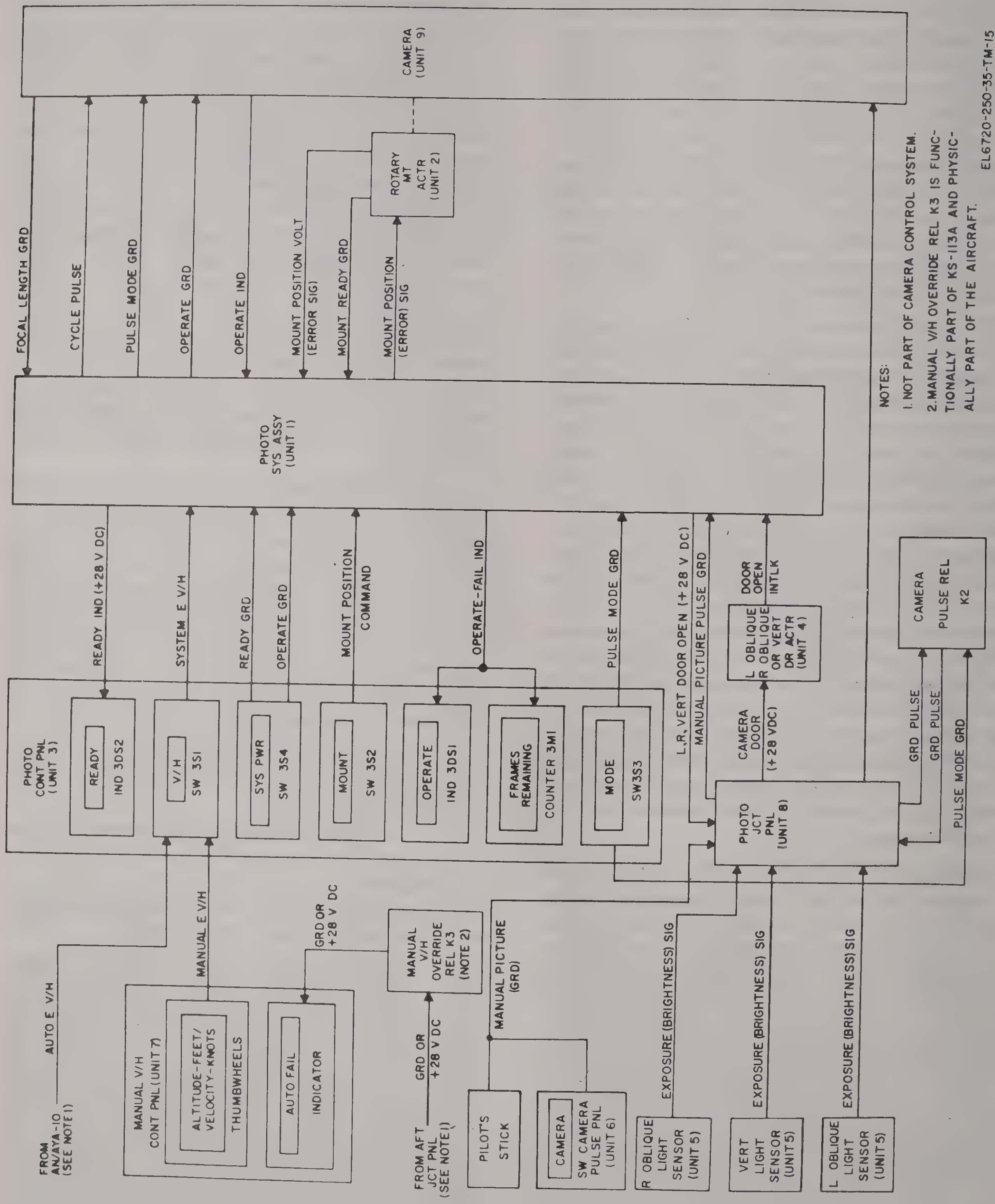


Figure 2-14. Pulse mode, block diagram.

manual V/H control panel (Unit 7) adjusted as required by mission flight requirements.

(1) *Film transport.* In the night mode of operation, the camera shutter is tripped automatically at a rate dependent upon measured film travel. Film moves through the camera at the IMC rate during exposure and during the interval between exposures. Camera shutter tripping action produces a pod assembly trigger I pulse output signal which causes the pod assembly to produce flash illumination in synchronism with shutter operation. Magnitude of the applied system E V/H signal determines pod assembly flash illumination intensity level. During the recycle period, film is transported at a greatly increased rate. In this operational mode, a 60 percent overlap of vertical exposures is automatically provided.

(2) *Power and control circuits.* Primary power application circuits (para 2–2*a* and *b*), camera mount positioning circuits (para 2–2*f*), camera window doors circuits (para 2–2*g*), exposure control circuits (para 2–2*c*) and monitoring circuits (para 2–2*h*) are used during this mode of operation.

(3) *Initiate circuits.* The night mode of operation is initiated by setting the SYS PWR switch 3S4 on photo control panel (Unit 3) to the OPERATE position. This action applies operate ground through the photo system assembly (Unit 1) to the camera (Unit 9).

(4) *Image motion compensation (manual E V/H signal).* Image motion compensation depends directly on the magnitude of the generated manual E V/H signal, camera depression angle and focal length of the installed lens cone (LA–370A, 1 3/4 inch). The IMC rate (speed at which film is moved) is determined by the magnitude of the applied manual E V/H signal. This IMC rate is established as follows:

(*a*) The VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels on manual V/H control panel (Unit 7) are manually adjusted to indicate aircraft altitude and velocity (obtained from aircraft instruments). Generated manual E V/H signal is routed through the V/H switch 3S1 (MANUAL position) on photo control panel (Unit 3), designated system E V/H, and then applied to the photo system assembly (Unit 1).

(*b*) A mount position command signal from the MOUNT switch 3S2 on photo control panel (Unit 3) is applied to the photo system assembly (Unit 1). A camera lens cone focal length ground signal is also applied to the photo system assembly (Unit 1). These signals control internal circuitry which compensates the applied system E V/H signal for camera depression angle (90°, vertical) and also focal length of the LA–370A (1 3/4 inch) lens cone installed on the camera (Unit 9). This compensated system E V/H signal is applied internally to the film drive amplifier module 1A2 within the photo system assembly (Unit 1) and externally to the pod assembly (Unit 10).

(*c*) The film drive amplifier module 1A2 within the photo system assembly (Unit 1) processes the internally compensated system E V/H signal to establish the + and – film drive (IMC) voltages. The + and – film drive voltage is applied to the camera (Unit 9) film drive circuits which transport film at the correct IMC rate. The camera (Unit 9) generates the –tachometer feedback (IMC) signal which is applied to the film drive amplifier module 1A2 within photo system assembly (Unit 1) to maintain the correct value of IMC control signal voltage.

(5) *Pod assembly flash triggering.* Flash trigger control of the pod assembly (Unit 10) is controlled through camera shutter operation. Each time the camera shutter is tripped, a pod assembly trigger I pulse is generated. This pulse is routed through the photo system assembly (Unit 1) and applied to the pod assembly (Unit 10). Application of this pulse results in a pod assembly (Unit 10) flash. The intensity level of the pod assembly (Unit 10) flash and illuminator module flash triggering sequence are directly dependent on the magnitude of the applied system E V/H signal.

2–6. Electronic Circuit Functions

a. Manual V/H Control Panel (Unit 7) (fig. 2–17).

(1) *General.* The manual V/H control panel provides visual warning when the automatic E V/H signal input to the camera control system has failed, generates a manual E V/H output signal, provides switching that allows manual overriding of the automatic E V/H signal, and generates the necessary dc operational voltages required for panel circuit. Functionally, the manual V/H control panel consists of the dc power and distribution circuit ((2) below), automatic E V/H fault detector circuit and automatic E V/H fault indicator and reset circuit ((3) below) –5-volt dc regulator circuit, +128 volts dc regulator circuit and manual E V/H output circuit ((4) below).

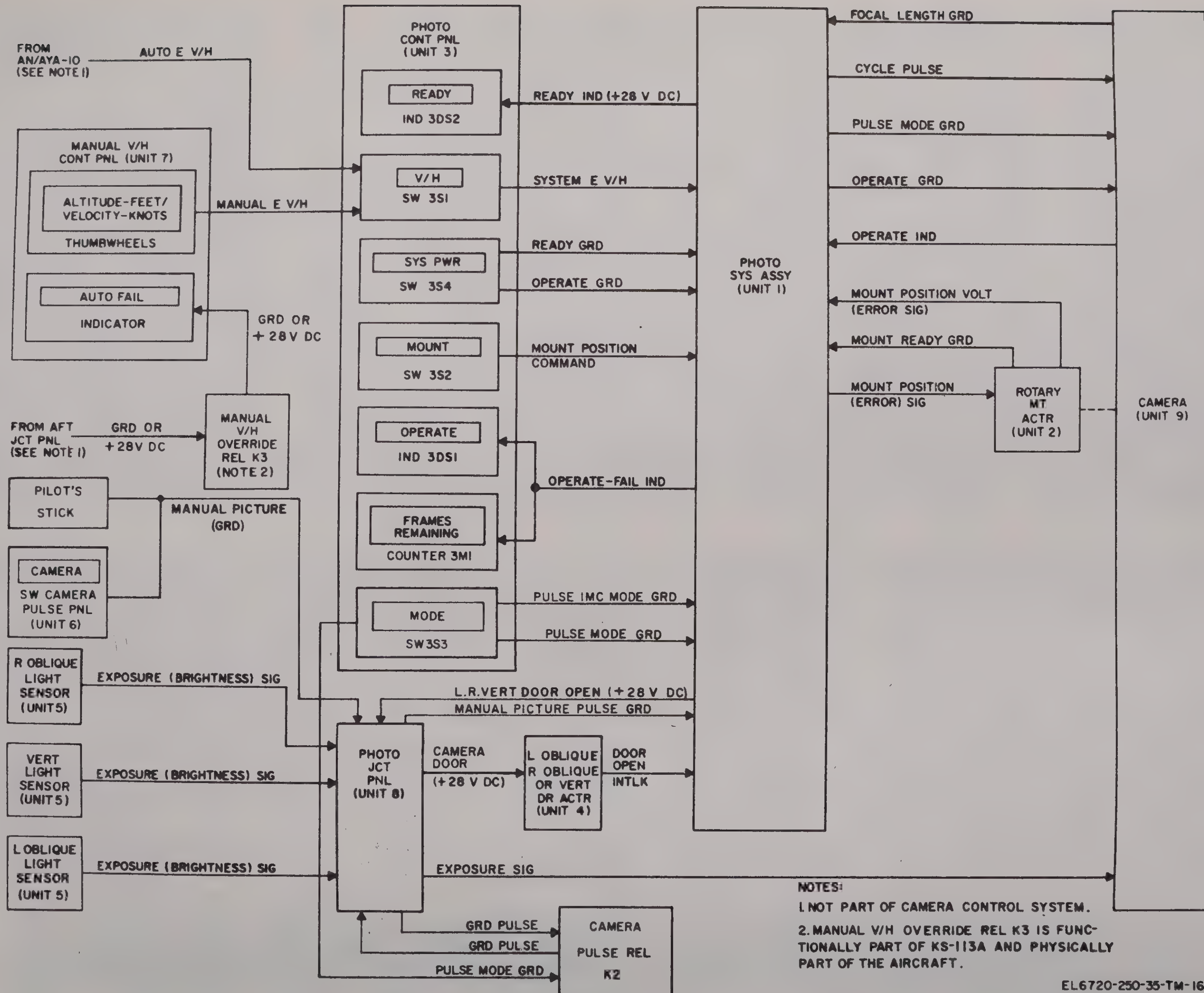


Figure 2-15. Pulse IMC mode, block diagram.

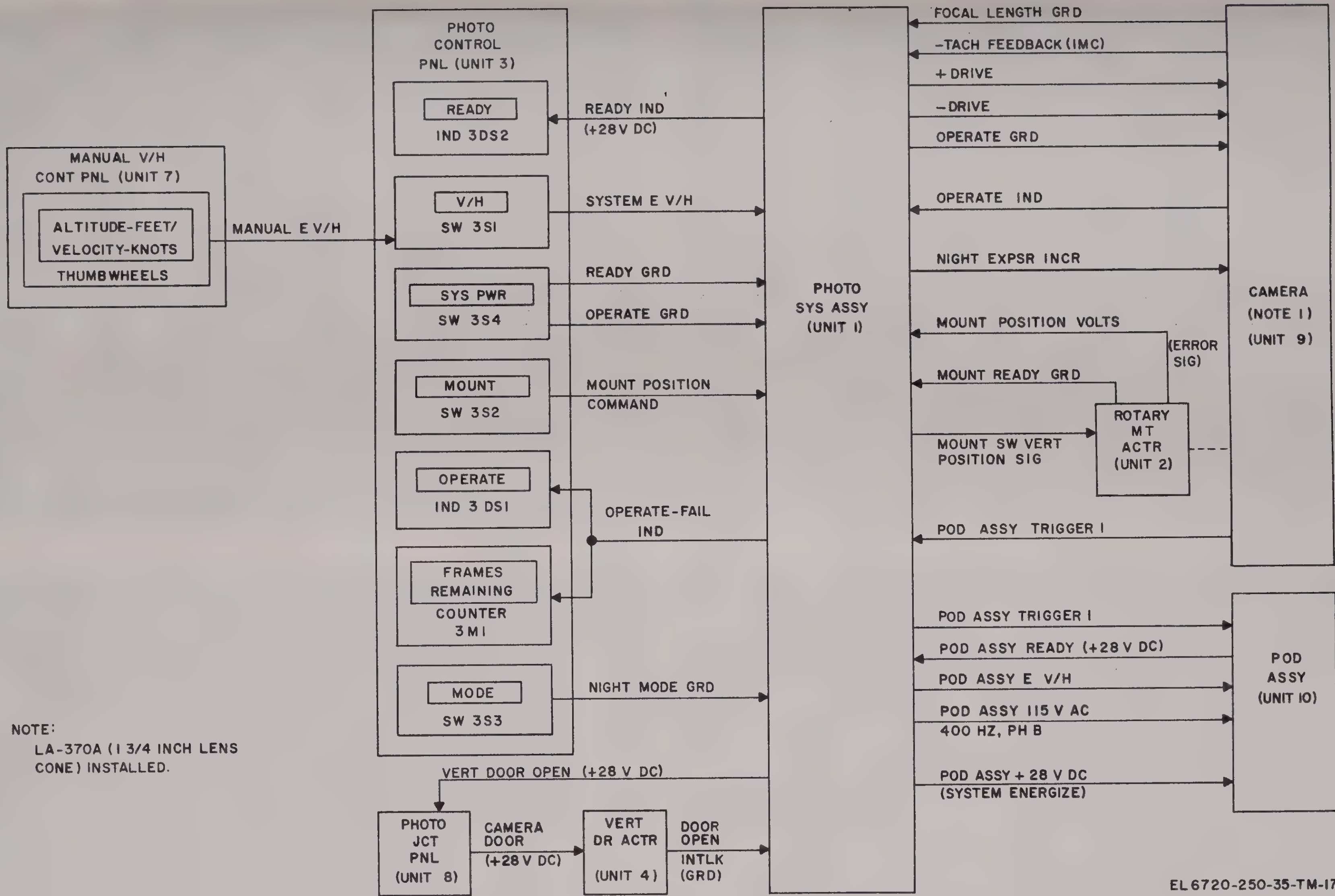


Figure 2-16. Night mode, block diagram.

(2) *Dc power and distribution circuit.* The dc power and distribution circuit utilizes 115 volts ac, 400 Hz, phase B input to generate five dc operating voltages of –3.3 volts dc, +5 volts dc, –24 volts dc, –110 volts dc and +150 volts dc required by circuits in the manual V/H control panel. Operating voltages of –24 volts dc, –110 volts dc, and +150 volts dc used in circuits which generate the manual E V/H signal are referenced to signal ground. Signal ground is isolated from chassis ground which is the reference for the remaining circuit voltages. The dc power and distribution circuit also routes +28 volts dc used as a switching voltage and +5 volts dc panel lamp voltage from external sources to the appropriate manual V/H control panel circuits.

(3) *Automatic E V/H fault circuits.* The automatic E V/H fault circuits consists of the automatic E V/H fault detector circuit and the automatic E V/H fault indicator and reset circuit. When either the radar altimeter fails (from Airborne Radar Navigation Aid System AN/APN–171) or automatic E V/H fails (from Air borne Data Annotation System AN/AYA–10), external circuitry removes the automatic E V/H signal from the camera control system and applies manual E V/H signal. External circuitry also applies the appropriate fail signal to the automatic E V/H fault detector circuit. The fail input signal causes the gated output of the automatic E V/H fault detector circuit to change from an open to an alternating open-ground. This alternating open-ground is applied to the automatic E V/H fault indicator and reset circuit which causes the front panel AUTO FAIL indicator to flash. The indicator will continue to flash until either the fail input signal is removed by external circuitry or reset is manually initiated in the automatic E V/H fault indicator and reset circuit. If reset is manually initiated, the gated output of the automatic E V/H fault detector circuit changes from an alternating output to a constant ground output. The constant ground causes the AUTO FAIL indicator to cease flashing and remain constantly lit. The dim command from external circuitry, when initiated causes a decrease in AUTO FAIL indicator brightness. The automatic E V/H fault indicator and reset circuit also applies a manual E V/H switching signal to external circuitry. When manually initiated, the manual E V/H switching signal causes external circuitry to remove automatic E V/H signal from the camera control system and apply manual E V/H signal.

(4) *Manual E V/H circuits.* The manual E V/H circuits consist of the –5-volt dc regulator circuit, +128 volts dc regulator circuit, and manual E V/H output circuit. The manual E V/H circuits are capable of supplying manual E V/H output signal over the required range of +0.600 volt dc to +100.6 volts dc. These circuits utilize –24 volts dc, –110 volts dc, and +150 volts dc from the dc power and distribution circuit to generate the manual E V/H signal. The –24 volts dc and +150 volts dc are applied to separate regulator circuits to obtain the –5 volts dc and +128 volts dc, respectively. These two voltages along with the –110 volts dc are applied by the manual E V/H output circuit. The manual E V/H output circuit consists of an operational amplifier controlled by the front panel VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels. Settings on the thumbwheels determine the voltage applied to the operational amplifier input. This input voltage level determines the operational amplifier output voltage which is the manual E V/H signal.

b. Photo Junction Panel (Unit 8) (fig. 2–18). The photo junction panel is used as a terminal board and switching device for various signals and voltages in the camera control system. These signals and voltages as well as associated circuits are discussed below.

(1) *Door ground safety relay 8K1.* When the left access door interlock switch S1 is actuated, camera door +28 volts dc is applied to the doors ground safety relay 8K1, thereby energizing the relay. This action applies the camera door +28 volts dc from the camera door circuit breaker CB88 to contacts of KA–76A override relay K4, nose gear up-lock switch S2, left camera door actuator relay 8K3, right camera door actuator relay 8K2 and vertical camera door actuator relay 8K4.

(2) *Right camera door actuator relay 8K2.* With the right camera door actuator relay 8K2 deenergized, camera door +28 volts dc from doors ground safety relay 8K1 is applied, as close door input, to the right door actuator (Unit 4). The right door open signal from the photo system assembly (Unit 1), via KA–76A override relay K4 or nose gear up-lock switch S2, is applied to the right camera door actuator relay 8K2, thereby energizing the relay. Circuit operation is as follows:

(*a*) Exposure (brightness) signal from the right light sensor (Unit 5) is applied to the camera (Unit 9).

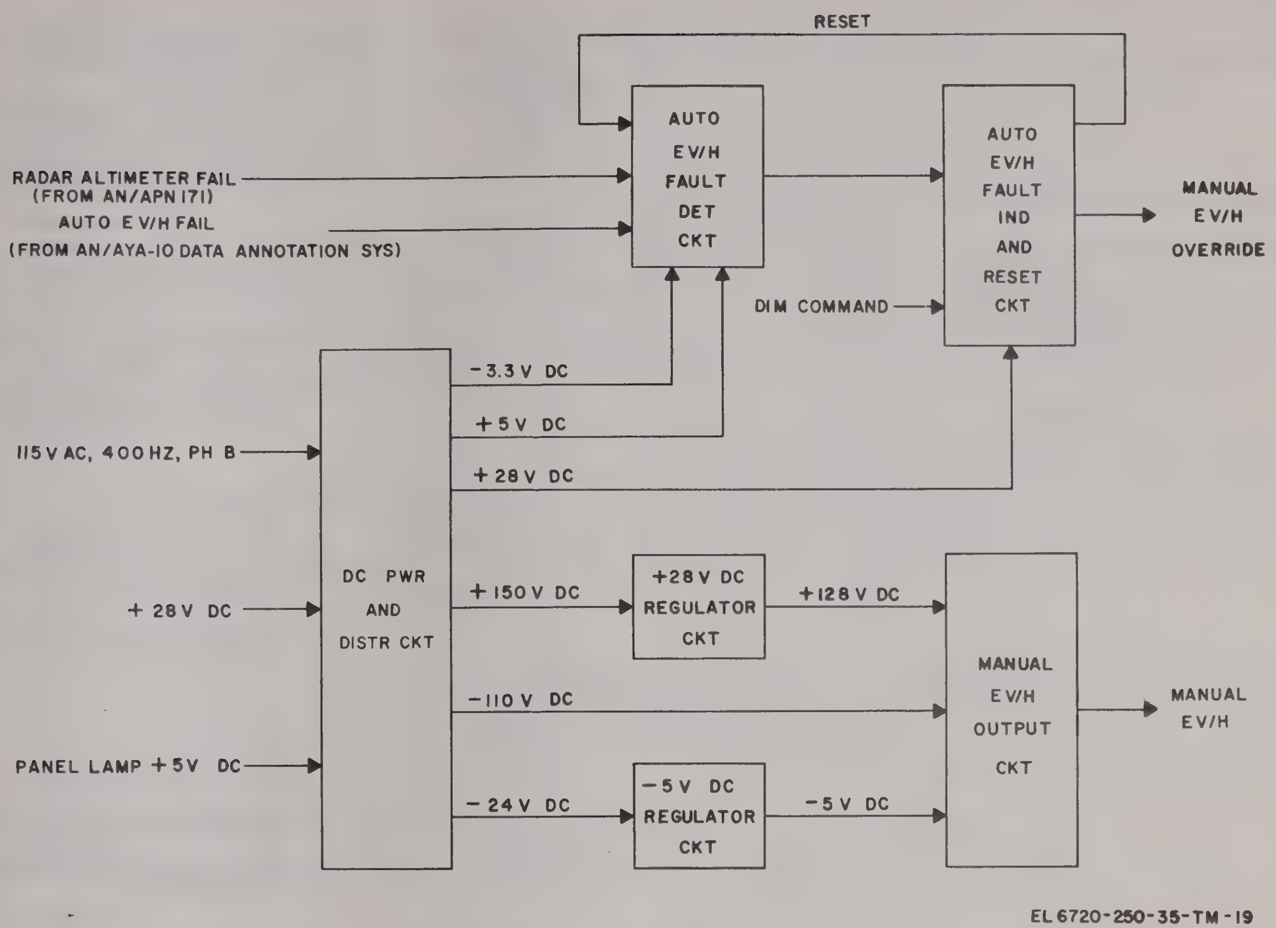


Figure 2–17. Manual V/H control panel, block diagram.

(*b*) Exposure signal return from the camera (Unit 9) is applied to the right light sensor (Unit 5).

(*c*) Camera door +28 volts dc from the nose gear up-lock switch S2 is applied, as open door input, to the right door actuator (Unit 4).

(3) *Left camera door actuator relay 8K3.* With the left camera door actuator relay 8K3 deenergized, camera door +28 volts dc from doors ground safety relay 8K1 is applied, as close door input, to the left door actuator (Unit 4). The left door open signal from the photo system assembly (Unit 1), via KA–76A override relay K4 or nose gear up-lock switch S2, is applied to the left camera door actuator relay 8K3, thereby energizing the relay. Circuit operation is as follows:

(*a*) Exposure (brightness) signal from the left light sensor (Unit 5) is applied to the camera (Unit 9).

(*b*) Exposure signal return from the camera (Unit 9) is applied to the left light sensor (Unit 5).

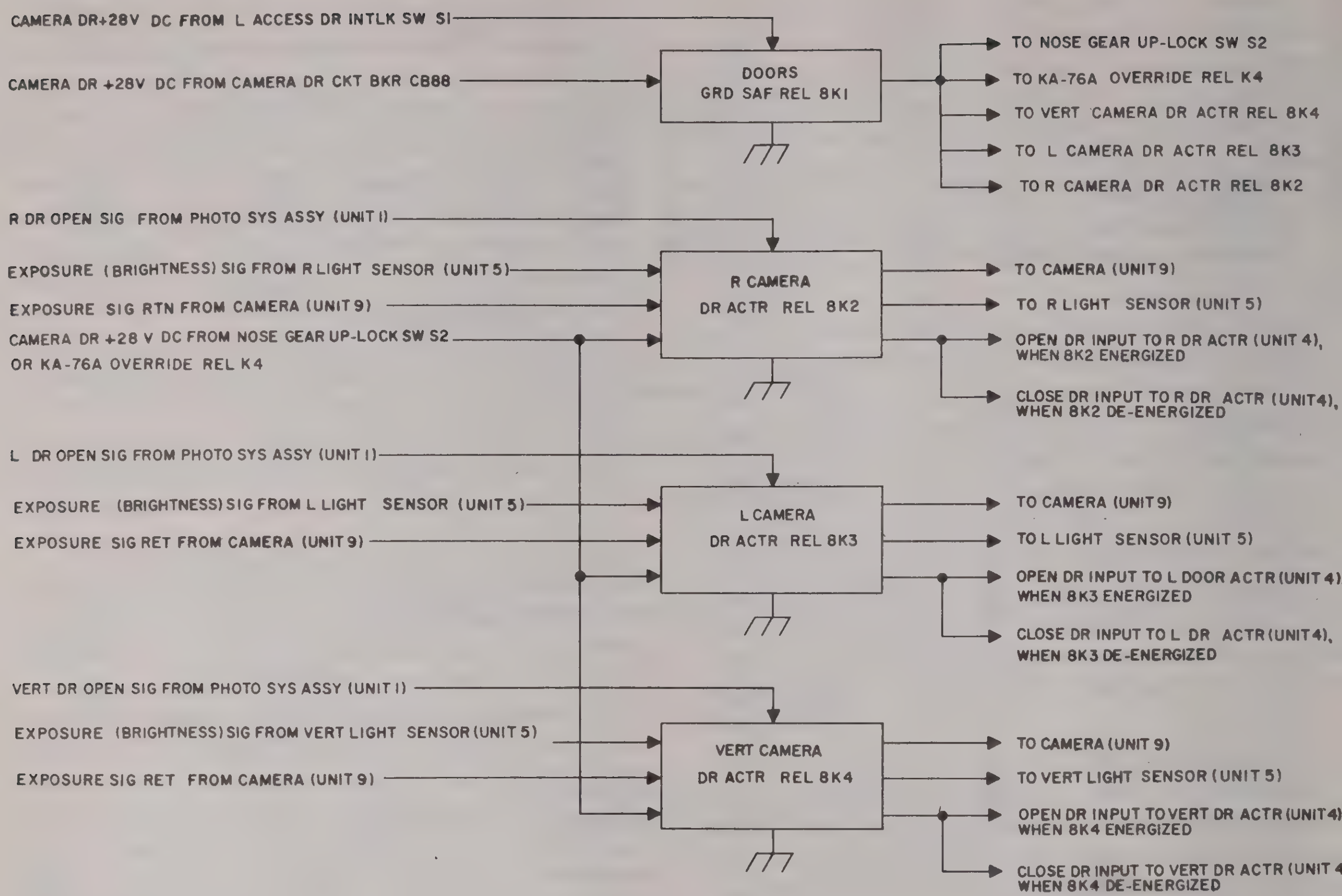
(*c*) Camera door +28 volts dc from the nose gear up-lock switch S2 is applied, as open door input, to the left door actuator (Unit 4).

(4) *Vertical camera door actuator relay 8K4.* With the vertical camera door actuator relay 8K4 deenergized, camera door +28 volts dc from doors ground safety relay 8K1 is applied, as close door input, to the vertical door actuator (Unit 4). The vertical door open signal from the photo system assembly (Unit 1), via KA–76A override relay K4 or nose gear up-lock switch S2, is applied to the vertical camera door actuator relay 8K4, thereby energizing the relay. Circuit operation is as follows:

(*a*) Exposure (brightness) signal from the vertical light sensor (Unit 5) is applied to the camera (Unit 9).

(*b*) Exposure signal return from the camera (Unit 9) is applied to the vertical light sensor (Unit 5).

(*c*) The +28 volts dc from KA–76A override relay K4 or doors ground safety relay 8K1 is applied, as open door input, to the vertical door actuator (Unit 4).



EL 6720-250-35-TM-20

Figure 2–18. Photo junction panel, block diagram.

c. Photo Control Panel (Unit 3) (fig. 2–19). The photo control panel provides the means to control operation of the camera control system, select camera mode of operation, and select the desired camera position for vertical or oblique photography.

(1) The dc ground from the photo system assembly (Unit 1) is applied to the MODE switch 3S3, SYS PWR switch 3S4, panel light 3A1, FRAMES REMAINING counter 3M1, OPERATE indicator 3DS1 and READY indicator 3DS2.

(2) Mount interlock ground from the KA-76A override relay K4 is applied to the MOUNT switch 3S2.

(3) Panel illuminate (+5 volts dc) from the internal and external lights panel is applied to the panel light 3A1, thereby causing the lamps to light.

(4) The manual E V/H from manual V/H control panel (Unit 7) and automatic E V/H from the Airborne Data Annotation System is applied to the V/H switch 3S1.

(5) When the SYS PWR 3S4 switch is set to the OPERATE position, an operate ground signal is supplied to the photo system assembly (Unit 1), which in turn provides the operating power for the camera (Unit 9) and pod assembly (Unit 10) (if used). Upon operation of the camera (Unit 9), an operate pulse signal is applied to the OPERATE indicator 3DS1 and FRAMES REMAINING counter 3M1 in the photo control (Unit 3), thereby causing the indicator to flash momentarily, and the counter will subtract one digit. If a malfunction occurs, during operation of the camera (Unit 9) a continuous fail signal (+28 volts dc from the camera, Unit 9), is applied to the OPERATE indicator 3DS1, thereby causing the indicator to light continuously. The FRAMES REMAINING counter 3M1 blocks this signal and prevents operation of its digital mechanism.

d. Photo System Assembly (Unit 1) (fig. 2–20). The photo system assembly receives input power signals from the camera control system and develops output control voltages and signals

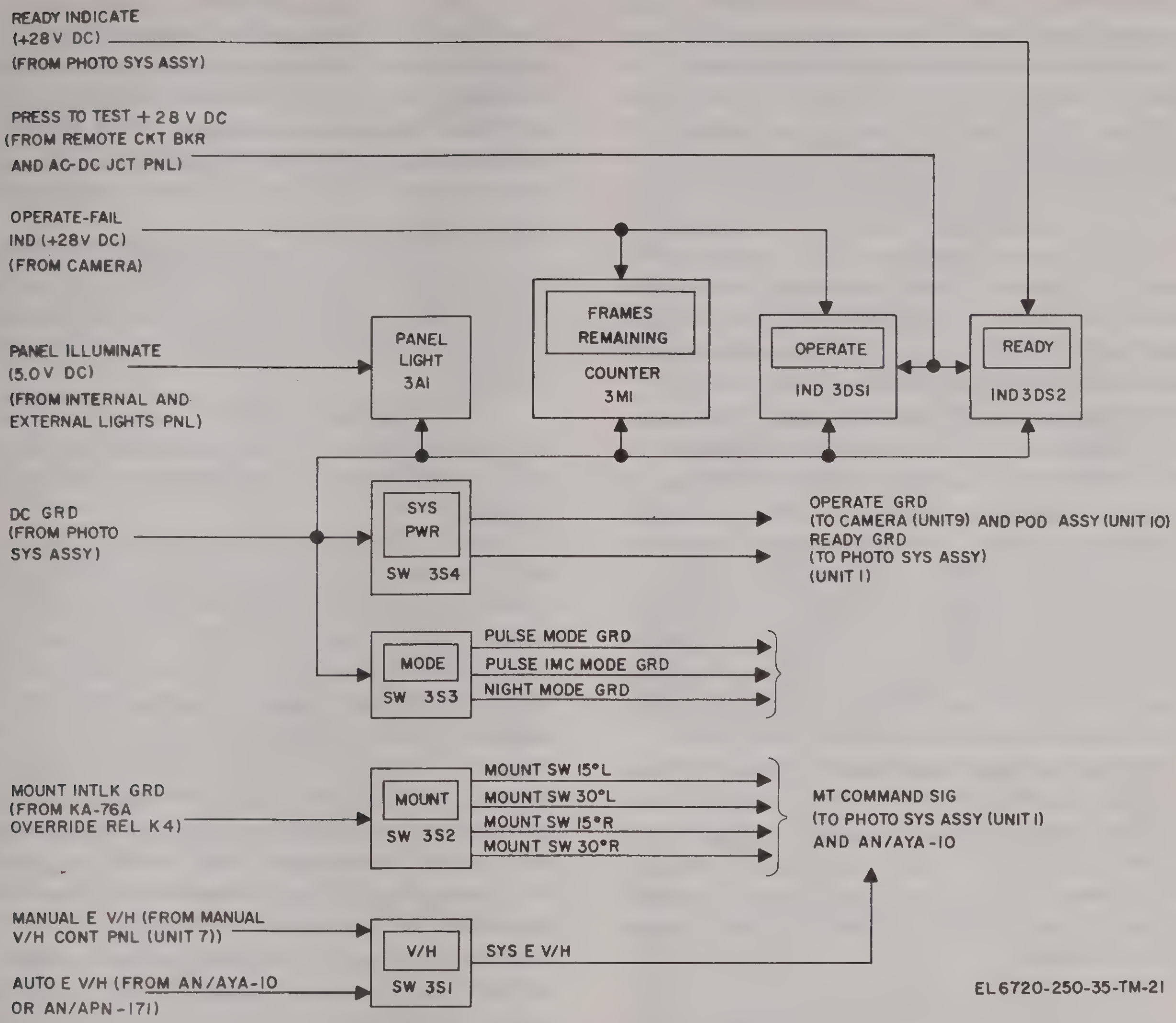


Figure 2-19. Photo control panel, block diagram.

necessary to operate the camera control system. These voltages and signals as well as associated circuits are discussed below.

(1) *Camera +28 volts dc.* The camera +28 volts dc from the aircraft remote circuit breaker and ac-dc junction panel is applied, as camera dc +28 volts, through the CAMERA DC 15 AMP fuse 1F1 and filter 1FL7 as follows:

(*a*) Direct to the one side of the coil and two contacts on dc power relay 1K1.

(*b*) Direct to the one side of the coil of ac power relay 1K2.

(2) *Ready ground signal.* When the SYS PWR switch 3S4 on the photo control panel (Unit 3) is set to READY position, ready ground signal is applied to the other side of the coils of dc power relay 1K1 and ac power relay 1K2 energizing the relays.

(*a*) With dc power relay 1K1 energized, camera dc +28 volts is applied through the normally open contacts of dc power relay 1K1 and filter 1FL1 to the following: pins D and F of connector 1XA1 of intervalometer module 1A1; pin N of connector 1XA2 of film drive amplifier module 1A2; pin 2 of connector 1XA3 of printed circuit board and component assembly module 1A3. Camera dc +28 volts from filter 1FL1 is applied to the following: one side of the coil of interlock relay 1K3; one side of the coil and one contact on night relay 1K4; one contact on ready relay 1K5; and one side of the coil and two contacts on manual picture relay 1K7. Camera dc +28 volts from the normally open contacts of dc power relay 1K1 is also applied to the camera (Unit 9), as +28-volt dc camera power.

(*b*) With ac power relay 1K2 energized, door open power (camera door +28 volts dc from aircraft remote circuit breaker and ac-dc junction panel) is applied through DOOR 2 AMP fuse 1F6, filter 1FL3 and normally open contacts of

ac power relay 1K2 to pin 21 of connector 1XA3 of printed circuit and component assembly module 1A3. The 115 volts ac, 400 Hz, phase B is applied through CAMERA AC 5 AMP fuse 1F4, filter 1FL4 and normally open contacts of ac power relay 1K2 to the following: pin H of connector 1XA1 of intervalometer module 1A1; one contact on night relay 1K4; camera (Unit 9); and HOURS meter indicator 1M1. The 115 volts ac, 400 Hz, phase B from the normally-open contacts of ac power relay 1K2 is also applied through filter 1FL2 to pin H of connector 1XA2 of film drive amplifier module 1A2.

(3) *Mount ready ground signal.* The mount ready ground signal from the rotary mount actuator (Unit 2) is applied to the other side of the coil of interlock relay 1K3, thereby energizing the relay. With interlock relay 1K3 energized, camera interlock (+28 volts dc) from camera (Unit 9) is applied through the normally open contacts of interlock relay 1K3, normally closed contacts of night relay 1K4 to the movable contact on pod assembly interlock relay 1K6, and one side of the coil of ready relay 1K5.

(4) *Doors open interlock (ground) signal.* The doors open interlock (ground) signal from either the left, right or vertical door actuator (Unit 4) is applied to the other side of the coil of ready relay 1K5, thereby energizing the relay. With ready relay 1K5 energized, circuit operation is as follows:

(*a*) Camera dc +28 volts from filter 1FL1 is applied through the normally open contacts of ready relay 1K5 to the READY indicator 3DS2 on photo control panel (Unit 3), thereby causing the indicator to light.

(*b*) When the SYS PWR switch 3S4 on the photo control panel (Unit 3) is set to OPERATE position, operate ground is applied through the normally open contacts of ready relay 1K5 to pin K of connector 1XA1 on intervalometer module 1A1 and to the camera (Unit 9).

(5) *Night mode ground signal.* When the MODE switch 3S3 on photo control panel (Unit 3) is set to NIGHT position, night mode ground signal is applied to the other side of the coil of night relay 1K4, thereby energizing the relay. With night relay 1K4 energized, circuit operation is as follows:

(*a*) Camera dc +28 volts from filter 1FL1 is applied through the normally open contacts of night relay 1K4 to the pod assembly (Unit 10), as pod assembly +28 volts dc.

(*b*) Camera interlock (+28 volts dc) from interlock relay 1K3 is applied through the normally-open contacts of night relay 1K4 to a stationary contact on pod assembly interlock relay 1K6. The camera interlock (+28 volts dc) is now removed from the movable contact on pod assembly interlock relay 1K6 and one side of the coil of ready relay 1K5.

(*c*) The 115 volts ac, 400 Hz, phase B from normally open contacts of ac power relay 1K2 is now applied through the normally-open contacts of night relay 1K4 to the pod assembly (Unit 10).

(*d*) Chassis ground is applied through the normally-open contacts of the night relay 1K4 to the camera (Unit 9), as night exposure increase.

(6) *Pod assembly ready (+28 volts dc).* When the ready interlock on the pod assembly closes, pod assembly ready +28 volts dc is applied to the other side of the coil of pod assembly interlock relay 1K6, thereby energizing the relay. With pod assembly interlock relay 1K6 energized, camera interlock (+28 volts dc) from the normally-open contacts of night relay 1K4 is applied through the normally open contacts of pod assembly interlock relay 1K6 to one side of the coil of ready relay 1K5. With ready relay 1K5 energized, circuit operation is the same as discussed in ((4)(*a*) and (*b*) above).

(7) *System E V/H.* When V/H switch 3S1 on the photo control panel (Unit 3) is set to either MANUAL or AUTO position, system E V/H is applied to pin 12 of connector 1XA3 on printed circuit board and component assembly module 1A3, and to pod assembly (Unit 10).

(8) *Negative tachometer feedback.* The –tachometer feedback signal from the camera (Unit 9) is applied to pin K of connector 1XA2 on film drive amplifier module 1A2.

(9) *Mount switch 15°L, 30°L, 15°R or 30°R ground.* When MOUNT switch 3S2 on photo control panel (Unit 3) is set to either L15°, L30°, R30° or R15°, mount switch ground is applied to pin 28, 19, 24 or 34, respectively, of connector 1XA3 on printed circuit board and component assembly module 1A3.

(10) *Mount 115 volts ac, 400 Hz, phase C.* The mount 115-volt ac, 400-Hz, phase C power from the aircraft remote circuit breaker and ac dc junction panel is applied through MOUNT 2 AMP fuse 1F5, filter 1FL4 to pin 10 of connector 1XA3 on printed circuit board and component assembly module 1A3.

(11) *Mount 15°L, 30°L, 90° (vertical), 15°R or 30°R volts.* The mount 15°L, 30°L, 90°, 15°R or 30°R (position) volts from the rotary mount actuator (Unit 2) is applied to pins 29, 16, 18, 35 or 25, respectively of connector 1XA3 on printed circuit board and component assembly module 1A3.

(12) *Compensated E V/H.* The compensated E V/H signal, developed by the printed circuit board and component assembly module is applied to pin T of connector 1XA1 of intervalometer module 1A1 and pin M of connector 1XA2 on film drive amplifier module 1A2.

(13) *LA–370A, LA–371A and LA–372A focal length ground.* The LA–370A (1 3/4 inch), LA–371A (3 inch) or LA–372A (12 inch) focal length ground from the camera (depending on lens cone used) is applied to pins 7, 6 or 5, respectively, of connector 1XA3 on printed circuit board and component assembly module 1A3. In addition, LA–370A (1 3/4 inch), LA–371A (3 inch) or LA–372A (12 inch) focal length ground is applied to the Airborne Data Annotation System AN/AYA–10.

(14) *Manual picture pulse (ground).* When CAMERA switch 6S1 on the camera pulse panel (Unit 6) or the camera pulse switch on the pilot's stick is actuated, manual picture pulse (ground) is applied to the other side of the coil of manual picture relay 1K7, thereby energizing the relay. With manual picture relay 1K7 energized, the circuit operation is as follows:

(*a*) Camera dc +28 volts from filter 1FL1 is applied through the normally-open contacts of manual picture relay 1K7 to the camera (Unit 9), as a cycle pulse.

NOTE

When manual picture relay 1K7 is deenergized, the cycle pulse from pin E of connector 1XA1 on intervalometer module 1A1 is applied through filter 1FL5 and normally-closed contacts of manual picture relay 1K7 to the camera (Unit 9).

(*b*) Camera dc +28 volts from filter 1FL1 is applied through normally-open contacts of manual picture relay 1K7 to the camera (Unit 9), as a + film drive voltage.

NOTE

When manual picture relay 1K7 is deenergized, the + film drive voltage, pin R of connector 1XA2 on film drive amplifier module 1A2, is applied through normally-closed contacts of manual picture relay 1K7 to the camera (Unit 9).

(*c*) Chassis ground is applied through normally open contacts of manual picture relay 1K7 to the camera (Unit 9), as – film drive voltage.

NOTE

When manual picture relay 1K7 is deenergized, the – film drive voltage from pin P of connector 1XA2 on film drive amplifier module 1A2 is applied through normally-closed contacts of manual picture relay 1K7 to the camera (Unit 9).

(15) *Pulse IMC mode ground.* When MODE switch 3S3 on the photo control panel (Unit 3) is set to PULSE IMC position, pulse IMC mode ground is applied through normally-closed contacts of manual picture relay 1K7 to the camera (Unit 9).

Figure 2–20. Photo system assembly, block diagram.
[Located in back of manual]

e. Rotary Mount Actuator (Unit 2) (fig. 2–21).

(1) *General.* The rotary mount actuator allows the camera mount A (Unit 11) or camera mount B (Unit 12) to be set to any one of five fixed positions. The rotary mount actuator consists of a dc motor, gearbox, and motor control and positioning circuits. The rotary mount actuator detects a change in newly selected camera mount position and the actual camera mount position. This action enables appropriate dc motor positioning circuits which cause the motor to rotate the camera mount to the newly selected camera mount position. The control circuits determine the slew rate of the dc motor while repositioning the camera mount. Functionally, the rotary mount actuator consists of the power and distribution circuit ((2) below), mount position error signal output circuit ((3) below), error and slew comparator amplifier circuit ((4) below), dc motor control and mount ready circuits ((5 below), and driver and dc motor circuit and gearbox ((6) below).

NOTE

In the following discussion, clockwise rotation of the dc motor moves the camera mount to the left; counterclockwise

rotation moves the camera mount to the right.

(2) *Power and distribution circuit.*

(*a*) The power and distribution circuit uses the mount 115-volt, 400-Hz, phase C input to develop six dc voltages, two phase-related ac voltages, and two drive pulse trains.

(*b*) Two of the six dc output voltages +12 volts dc and –6 volts dc, are unregulated and used as circuit operating voltages. The +9 volts dc and –5.1 volts dc are regulated and used as reference voltages in the mount position error signal output, and the error and slew comparator amplifier circuits. The +100-volt dc and –100-volt dc outputs are also used as reference voltages in the mount position error signal output circuit. Of the six dc voltages developed in the power and distribution circuit, all except +100 volts dc and –100 volts dc are referenced to dc ground and chassis ground. The +100-volt dc and –100-volt dc outputs are isolated from ground.

(*c*) The power and distribution circuit also develops two 115-volt ac, 400-Hz voltages (180° out of phase with each other) which are required by the driver and dc motor circuit.

(*d*) The power and distribution circuit also develops two drive voltages consisting of two 400-Hz pulse trains. These pulse trains are required by the 800 pulses-per-second (PPS) generator in the mount ready and multivibrator circuit.

(3) *Mount position error signal output circuit.* Mount position error signal output circuit develops five mount position voltages (error signal). The five dc mount position voltages electrically represent selected camera mount positions of 15° left, 30° left, 90° vertical, 30° right, and 15° right. When a new camera mount position is manually selected by the photo control panel (Unit 3), the difference between the voltage representing the newly selected camera mount position and the voltage representing the actual camera mount position is algebraically summed. The resultant summed voltage is routed through external circuitry from the mount position (error) signal output circuit to the error and slew comparator amplifier circuit. The error and slew comparator amplifier circuit, through associated dc motor control circuitry, causes the dc motor to rotate the camera mount A (Unit 11) or camera mount B (Unit 12) to the newly selected position. As the dc motor repositions the camera mount, a wiper on a followup potentiometer in the mount position error signal output circuit is also repositioned by the dc motor. When the voltage, present at the wiper of the followup potentiometer, is the same as the voltage representing the selected camera mount position, the algebraic sum is zero (null). When the null is obtained, the error and slew comparator amplifier circuit through associated gating circuits cause the dc motor to stop.

(4) *Error and slew comparator amplifier circuit.* The error and slew comparator amplifier circuit consists of four comparator amplifiers and associated circuitry. An algebraic sum of the voltage representing the newly selected camera mount position and the voltage representing the actual camera mount position is applied as the mount position (error) signal to the error and slew comparator amplifier circuit. If the mount position (error) signal is positive, the counterclockwise error and slew comparator amplifiers output voltage will change from negative to positive in polarity. If the mount position (error) signal is negative, the clockwise error and slew comparator amplifiers output voltage will change from negative to positive in polarity. The output of the two appropriate error and slew comparator amplifiers will remain positive until the mount position (error) signal decreases to a predetermined comparator amplifier reference level. At this time, the comparator amplifiers output will change from positive to negative in polarity. Due to circuit alignment, the slew comparator amplifier output will change from positive to negative in polarity before the corresponding error comparator amplifier output changes from positive to negative in polarity. The positive and negative outputs of the four comparator amplifiers are used to enable or disable appropriate dc motor control and mount ready circuits.

(5) *Dc motor control and mount ready circuits.* The dc motor control and mount ready circuit consists of the mount ready and multivibrator disable circuit, 800 pulses-per-second generator and multivibrator circuit, clockwise gate and trigger circuit and counterclockwise gate and trigger circuit. In the following discussion it is assumed that the selected camera mount position has been changed, thereby requiring a clockwise rotation of the dc motor to reposition the camera mount. The counterclockwise circuit functions are identical to the clockwise circuit functions, therefore need not be discussed.

(*a*) The clockwise error and slew signals from the error and slew comparator amplifier cir-

cuit change from negative to positive polarity. The positive clockwise error signal enables the clockwise gate and trigger circuit and opens the mount ready ground through the mount ready and multivibrator disable circuit. The positive clockwise slew signal prevents the nonsymmetrical multivibrator output in the 800 pulses-per-second generator and multivibrator circuit from being applied to the clockwise gate and trigger circuit. The clockwise gate and trigger is enabled; the 800 pulses-per-second from the 800 pulses-per-second generator and multivibrator circuit is the only input to the clockwise gate and trigger circuit, and the output applied to the driver and dc motor circuit is a function of this input.

(*b*) When the actual camera mount position nears the newly selected camera mount position, the clockwise slew signal from the error and slew comparator amplifier circuit changes from positive to negative polarity. The negative clockwise slew signal is applied to the mount ready and multivibrator disable circuit. The negative clockwise slew signal enables the nonsymmetrical output of the multivibrator in the 800 pulses-per-second generator and multivibrator circuit to be applied to the input of the clockwise gate and trigger circuit. This results in both the 800 pulses-per-second generator output and the nonsymmetrical multivibrator output being applied to the clockwise gate and trigger circuit input. However, due to a difference in pulse duration and frequency, the nonsymmetrical multivibrator output is the controlling input. As a result, the clockwise trigger output applied to the driver and dc motor circuit is a function of the nonsymmetrical multivibrator output. This results in a decrease in frequency of the clockwise trigger output.

(*c*) When the actual camera mount position is the same as the newly selected camera mount position, the clockwise error signal from the error and slew comparator amplifier circuit changes from positive to negative polarity. The negative clockwise error signal disables the clockwise gate and trigger circuit, thereby removing the clockwise trigger output to the driver and dc circuit. In addition, the negative clockwise error signal is applied to the ready and multivibrator disable circuit and results in a ground being applied to the mount ready ground output.

(6) *Driver and dc motor circuit gearbox.* The driver and dc motor circuit consists of two phase-controlled rectifiers, two limit switches, and a reversible dc motor. The dc motor drives a 430 to 1 gearbox. When the selected camera mount position is changed, either the clockwise gate and trigger circuit or the counterclockwise gate and trigger circuit applies a trigger pulse train to the driver and dc motor circuit. The gate and trigger circuit which applies the trigger pulse train depends on the direction the dc motor has to be rotated to reposition the camera mount. The trigger pulse train activates one of two phase-controlled, full-wave rectifier networks which applies a dc voltage to the dc motor. If the dc motor has to rotate clockwise, the phase-controlled, full-wave rectifier network applies a negative dc voltage; if the dc motor has to rotate counterclockwise, the phase-controlled, full-wave rectifier network applies a positive dc voltage. As the actual camera mount position nears the newly selected camera mount position, the frequency of the trigger pulse train from the appropriate gate and trigger circuit decreases. This decrease in trigger pulse frequency results in a decrease in dc voltage applied to the motor and causes it to rotate at a slower speed. A cam-operated limit switch is in series with each phase-controlled, full-wave rectifier network. If electrical misalignment occurs, the dc motor could mechanically overdrive the motor-driven parts. If this occurs, the appropriate limit switch will open the circuit to the dc motor, thereby preventing any mechanical damage. The dc motor drives a 430 to 1 gearbox which mechanically positions the camera mount, the followup potentiometer in the mount position error signal output circuit, and operates the cam associated with the limit switches.

f. Door Actuator (Unit 4) (fig. 2-22). The left door actuator, right door actuator and vertical door actuator are identical. Each door actuator opens and closes the respective camera window door. Depending on the position of the MOUNT switch on the photo control panel (Unit 3), appropriate drive power (open and close) is applied to the door actuator (Unit 4) through the camera door actuator relays 8K2, 8K3 or 8K4 in the photo junction panel (Unit 8). The following discussion applies to any door actuator (Unit 4).

(1) When power (+28 volts dc) is applied to pin A of connector J1, the door open brake and field windings of motor B1 are energized. Energizing the brake and field windings disengages the brake, removing brake action from the motor armature. This permits the armature to rotate and retract the door actuator shaft, opening the camera window door. When the camera win-

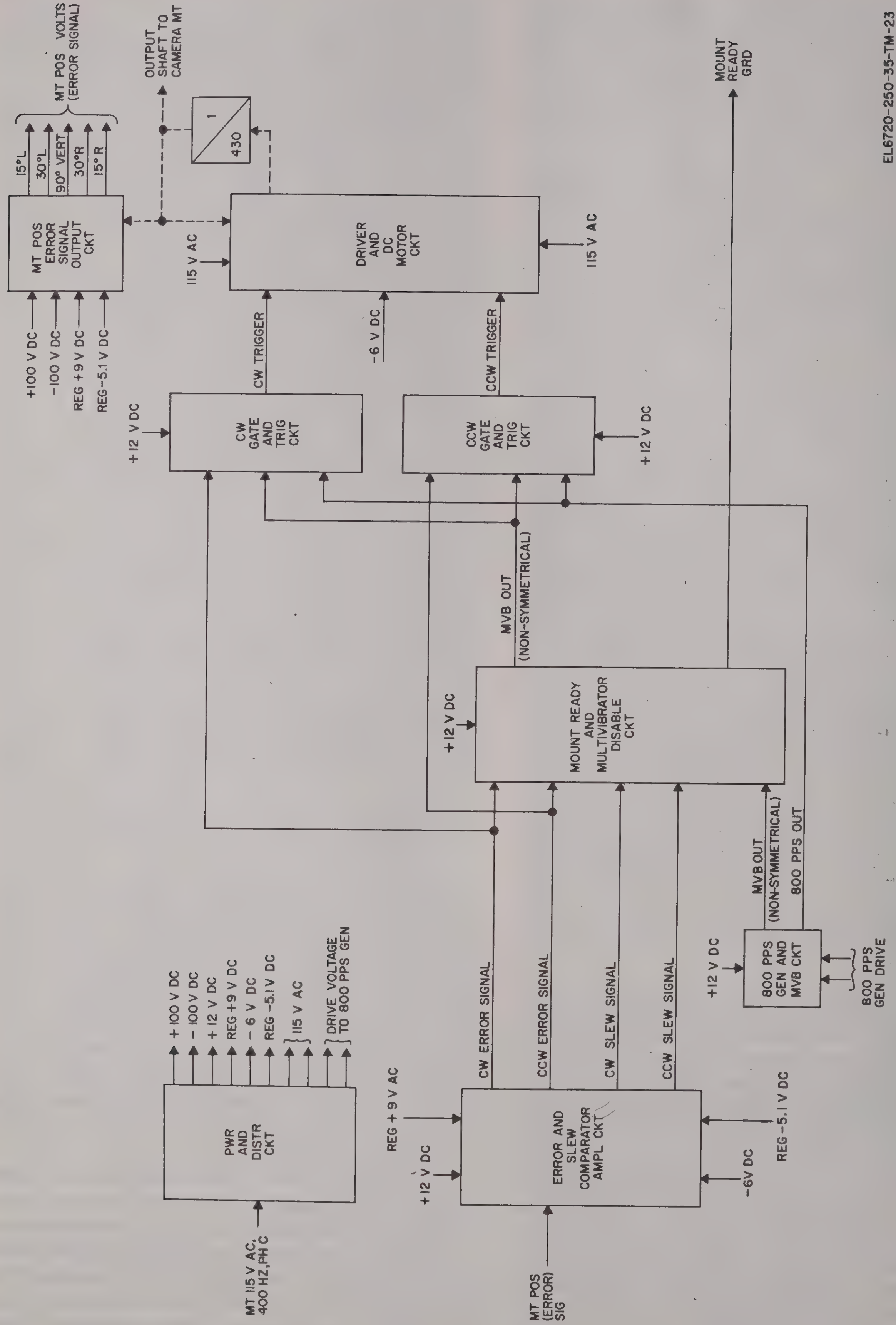


Figure 2-21. Rotary mount actuator, block diagram.

dow door is fully opened, retract limit switch S3 (connected in series with the door open brake and field windings) is opened, disconnecting power (+28 volts dc) to and deenergizing the door open brake and field windings. As a result, braking action is applied to the motor armature, stopping the motor. When the camera window door is fully opened, the following takes place; door open interlock ground limit switch S4 is closed providing a ground through pin E of connector J1 to the ready relay in the photo system assembly (Unit 1); extend limit switch S2 closes, enabling the door close circuit.

(2) When power (+28 volts dc) is applied to pin B of connector J1, the door close brake and field windings of motor B1 are energized. Energizing the brake and field windings disengages the brake, removing the brake action from the motor armature. This permits the armature to rotate and extend the door actuator shaft, closing the camera window door. When the camera window door is fully closed, the extend limit switch (connected in series with the door close brake and field windings) is opened, disconnecting power (+28 volts dc) to the door close brake and field windings and deenergizing them. As a result, braking action is applied to the motor armature, thus stopping the motor B1. When the camera window door is fully closed, the following takes place; door close interlock ground limit switch is opened removing the ground (through pin E of connector J1) to the ready relay 1K5 in the photo system assembly (Unit 1); retract limit switch S3 closes, enabling the door open circuit.

(3) Capacitors C1 and C2 are used to short circuit and reverse surge current to ground when the limit switches are opened. RF filter FL1 eliminates RF interference in the power line.

g. Light Sensor (Unit 5) (fig. 2-23). The light sensor consists of a photo cell V1 that produces an output signal voltage when triggered by light reflected from the terrain or object to be photographed. This signal voltage, which is proportional to light intensity, is coupled to the camera (Unit 9) for use as an exposure (brightness) signal. The positive terminal of photo cell V1 is connected to ground through pin C of pendant connector P1. The negative or signal terminal of the photo cell is applied to the camera exposure circuit through pin B of connector P1. The cable shield is connected to ground through pin A of connector P1.

h. Camera Pulse Panel (134AV81400-1 or 134AV81400-3) (Unit 6) (fig. 2-24). Camera pulse panels 134AV81400-1 and 134AV81400-3 are identical with the exception of length of interconnecting wiring. The CAMERA pulse switch S1 may be used when the camera control system is operated in either pulse or pulse IMC mode. When depressed, CAMERA pulse switch S1 applies a ground through the photo junction panel (Unit 8) which causes the camera (Unit 9) to operate at the maximum cycle rate as long as the switch is depressed. The two front panel edge lamps DS1 and DS2 receive +5 volts dc from the internal and external lights panel.

i. Pod Assembly (Unit 10). Refer to TM 11-6760-228-35-1, for electronic circuit functioning of pod assembly. Refer to figures 2-37 and 2-38 for aircraft wiring of pod assemblies (Unit 10) installed at aircraft wing stations 1, 2 or 5.

j. Camera (Unit 9). Refer to TM 11-6720-236-35 for electronic circuit functioning of camera.

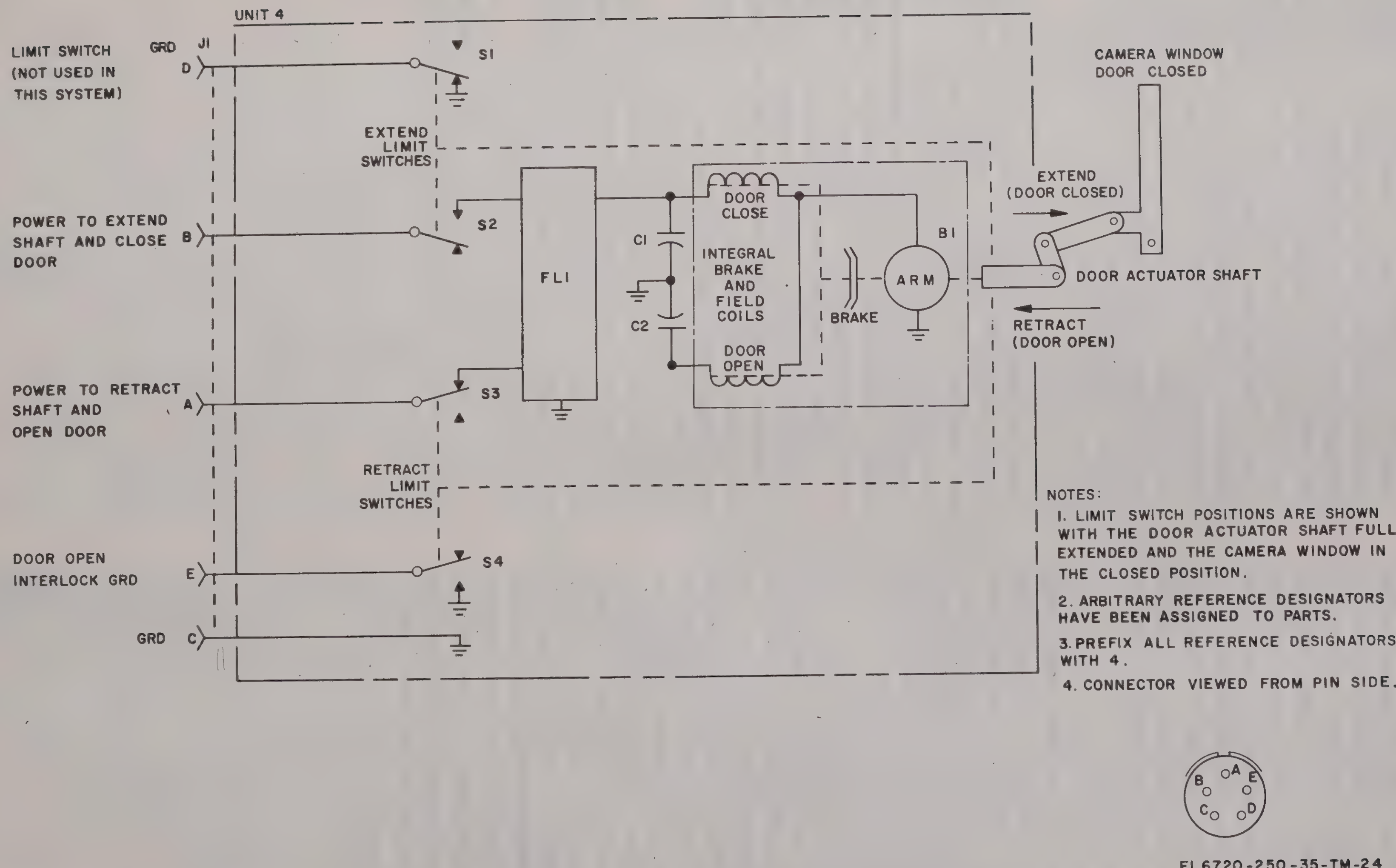


Figure 2–22. Left, right, or vertical door actuator, schematic diagram.

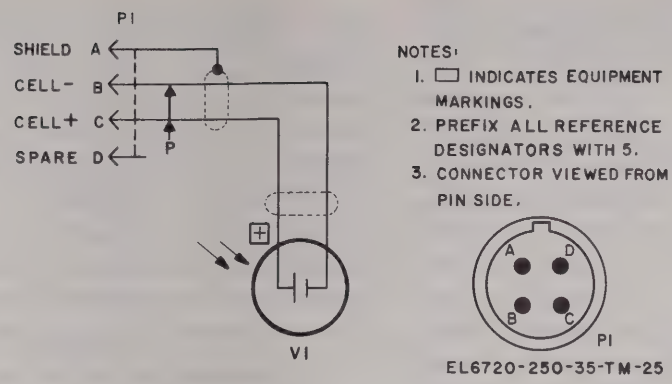


Figure 2-23. Left, right, or vertical light sensor, schematic diagram.

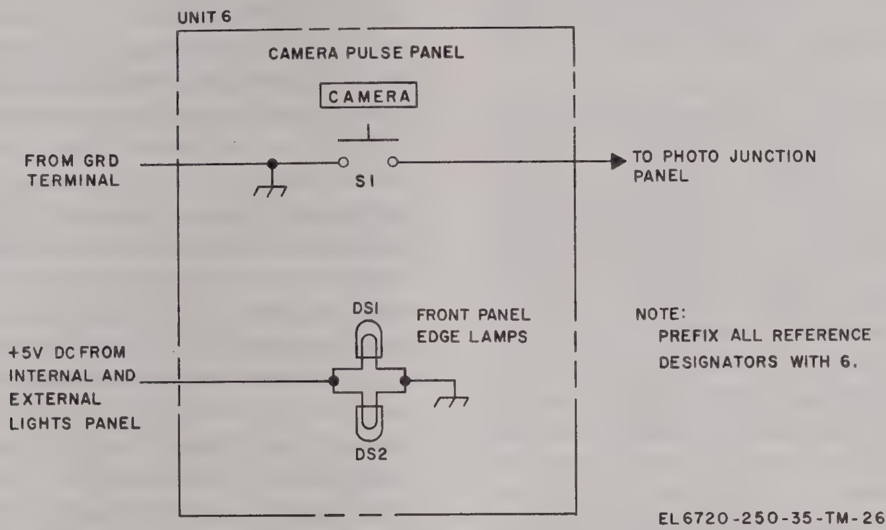


Figure 2-24. Camera pulse panel, schematic diagram.

Section II. STAGE FUNCTIONING

2-7. Manual V/H Control Panel (Unit 7) Circuits

a. Dc Power and Distribution Circuit (fig. 2-25).

(1) *General.* The dc power and distribution circuit generates five dc output voltages and routes +28 volts dc switching voltage and +5-volt dc lamp voltage from external circuitry to appropriate manual V/H control panel circuits. The circuit consists of POWER switch S1, 0.5 AMP fuse F1, three power transformers, three rectifiers with associated filters and four regulators. Parts comprising the dc power and distribution circuit are located on the front panel, rear panel, module A1, and chassis of the manual V/H control panel.

(2) *Power application.* The input 115 volts ac, 400 Hz, phase B from the aircraft remote circuit breaker and ac-dc junction panel is applied through 0.5 AMP fuse F1 and filter FL1 to POWER switch S1. When POWER switch S1 is set to ON, 115 volts, ac, 400 Hz, phase B is applied to one side of the primary of power transformers T1 through T3. The ac ground is applied to the other side of the primary of power transformers T1 through T3.

NOTE

The ac ground and dc ground are connected together internally. The shield ground and chassis ground are also connected together internally. Signal ground, however, is isolated from chassis ground.

(3) *+150 vdc and -110 vdc power supplies.* The output of the secondary of transformer T1 is applied across a bridge rectifier consisting of diodes A1CR1 thru A1CR4. The +150-volt dc output from the bridge rectifier (junction of A1CR1 and A1CR2) is filtered by capacitors A1C3 and A1C4 and applied across resistor bleeder network A1R3, A1R4 to the +128 volt

dc regulator circuit (*e* below) and test jack A1TP6. The -150-volt dc output from the bridge rectifier (junction of A1CR3 and A1CR4) is filtered by capacitors A1C1, A1C2 and applied across resistor bleeder network A1R1, A1R2 and through series resistor A1R5 to -110-volt dc Zener diode regulator VR1. The regulated -110-volt dc output is applied to the manual E V/H output circuit (*f* below) and test jack A1TP2. The common (signal ground) for both the +150-volt dc and -110-volt dc outputs is obtained from a center tap on the secondary of power transformer T1 and test jack A1TP7. Test jacks A1TP6 (+150 volts dc), A1TP2 (-110 volts dc), and A1TP7 (signal ground) are provided to allow external monitoring of the two power supply outputs.

(4) *-24 vdc power supply.* The output of the secondary of transformer T3 is applied to a full-wave rectifier consisting of diodes A1CR9 and A1CR10. The negative output from the full-wave rectifier, filtered by capacitors C8 and A1C5, is applied through series resistor A1R8 to -24-volt dc Zener diode regulator A1VR3. The regulated -24-volt dc output is applied to the -5-volt dc regulator circuit (*d* below) and test jack A1TP1. Test jack A1TP1 (-24 volts dc) and A1TP7 (signal ground) are provided to allow monitoring of the -24-volt dc output.

(5) *+5 vdc and -3.3 vdc power supplies.* The output of the secondary of transformer T2 is applied across a bridge rectifier consisting of diodes A1CR5 thru A1CR8. The positive output from the bridge rectifier, filtered by capacitor C7, is applied through series resistor A1R6 to +4.7 volt zener diode regulator A1VR1. The regulated +4.7-volt dc output is applied to the automatic E V/H fault detector circuit and test jack A1TP4, as the +5 volt dc input (*b*(2) below). The negative output from the bridge rectifier, filtered by capacitor C9, is applied through series resistor A1R7 to 3.3-volt Zener diode regulator A1VR2. The regulated -3.3 vdc output is applied to the automatic E V/H fault detector circuit (*b*(2) below) and test jack A1TP5. Test jacks A1TP4 (+4.7 volts dc), A1TP5 (-3.3 volts dc) and A1TP3 (chassis ground) are provided to allow monitoring of the power supply outputs.

(6) *+28 vdc and +5 vdc power distribution.* The +28 volts dc from the aircraft remote circuit breaker and ac-dc junction panel is applied through line filter FL2 to the automatic E V/H fault indicator and reset circuit (*c*(2)(*a*) below). The +5 volts dc from the internal and external lights panel is applied to the front panel edge lamps and to VELOCITY-KNOTS and ALTITUDE-FEET indicator lamps in S5 and S6, respectively. Both the +28 volts dc and +5 volts dc are referenced to chassis ground.

b. Automatic E V/H Fault Detector Circuit (fig. 2-26).

(1) *General.*

(*a*) The automatic E V/H fault detector circuit is activated when a failure occurs in either the Airborne Radar Navigation Aid System AN/APN-171 or Airborne Data Annotation System AN/AYA-10. During normal operation, with no detected failure, the gated output of the automatic E V/H fault detector circuit is open. When a failure occurs, the gated output alternates between an open circuit and ground at an approximate frequency of 1 Hz. The alternating output will continue until the failure is corrected or a reset is initiated in the automatic E V/H fault indicator and reset circuit. When the failure is corrected, the automatic E V/H fault detector circuit gated output changes to an open circuit. If reset occurs before the failure is corrected, the gated output changes to a constant ground.

(*b*) The automatic E V/H fault detector circuit also contains AUTO FAIL TEST switch S4 which, when activated, simulates a failure in the Airborne Radar Navigation Aid System AN/APN-171. Parts comprising the automatic E V/H fault detector circuit are located on the front panel and module A5A2 of the manual V/H control panel. The chart in (2) below lists the various voltage levels used in the description of logic circuits.

(2) *Logic voltage levels.* For purposes of describing logic circuitry operation in the automatic E V/H fault detector circuit, the following chart defines the various high and low input and output voltage levels.

Description	Parameter	High	Low
Inverters Q6 and Q7	Input level	+28 vdc	-3.3 vdc
	Output level	+5 vdc	Ground
Inverter Q5	Input level	+5 vdc	Ground
	Output level	+5 vdc	Ground
NAND gates in Z1 (4)	Input level	+5 vdc	Ground

Description	Parameter	High	Low
	Output level	+5 vdc	Ground
ultivibrator Q3, Q4	Output level	+5 vdc	Ground
lip-flop Z2	Set input level	+5 vdc	N/A
	Clear input level	N/A	Ground
	Toggle input level	+5 vdc	Ground
	"0" latch input level	+5 vdc	Ground
	"0" output level	+5 vdc	Ground
	"1" output level	+5 vdc	Ground
AND gate CR1, CR2, Q1, Q2.	Input level	+5 vdc	Ground
	Output level	Open	Ground

(3) *Normal circuit conditions.* The following E V/H fault detector circuit conditions exist when there is no failure in either the Airborne adar Navigation Aid System AN/APN-171 or ne Airborne Data Annotation System AN/YA-10.

(*a*) The radar altimeter fail input (+28 olts dc) at pin K of connector J1 is applied rough resistor R5, normally closed contacts of UTO FAIL TEST switch S4, pin D of connecor J2, to the input of two series inverters consting of transistors Q6 and Q5. The two series verters change the +28 volt dc high input to a 5 volt dc high output.

(*b*) The automatic E V/H fail (0 volts c) input at pin F of connector J1 is applied rough pin J of connector J2 to the input of inerter Q7 and results in a high inverter output.

(*c*) The high outputs of inverters Q5 and 7 are combined and applied to the toggle input on the flip-flop (terminal 2 of Z2) and to e input of NAND gate D (terminal 9 of Z1). he "1" output of the flip-flop (terminal 1 of 2) is low and the "0" output (terminal 9 of 2) is high. The high at the toggle input does ot cause the flip-flop Z2 to change from the ormal "0" state to the "1" state. The "1" output of the flip-flop (terminal 1 of Z2) is high. ne "0" latch input to the flip-flop (terminal 5 Z2) remains high because reset has not been itiated and therefore does not affect circuit eration.

(*d*) NAND gate A in Z1 receives a low put (terminal 1 of Z1) from the flip-flop "1" tput (terminal 6 of Z2) and a second input erminal 2 of Z1) from the output of a freenning multivibrator consisting of transistors and Q4. Since the input from the flip-flop is low, the gate is not enabled which results a high output (terminal 3 of Z1).

(*e*) NAND gate B in Z1 receives a high out (terminal 12 of Z1) from the flip-flop "0" output (terminal 9 of Z2). This results in a low output (terminal 11 of Z1).

(*f*) Both NAND gates A and B outputs (terminals 3 and 11 of Z1) are combined and applied to the input of NAND gate C (terminal 4 of Z1). The NAND gates A and B outputs are opposite (one high, one low); however, when combined the low is the controlling level and is applied to the input of NAND gate C.

(*g*) The low input to NAND gate C (terminal 4 of Z1) results in a high output (terminal 6 of Z1).

(*h*) The high input to NAND gate D (terminal 9 of Z1) from the combined output of inverters Q5 and Q7 results in a low output (terminal 8 of Z1).

(*i*) Both NAND gate C high output (terminal 6 of Z1) and NAND gate D low output (terminal 8 of Z1) are combined and applied to one input of the NAND gate. Since the low output is the controlling level, a low is applied to the NAND gate input.

(*j*) The output NAND gate consists of a pair of diodes CR1 and CR2 which function as an AND gate, and a pair of Darlington-connected transistors Q1 and Q2 which function as an inverter and lamp drivers. When combined, the diodes and transistors function as a NAND gate. One input to the output NAND gate is high (+5 volts dc) and the other input (terminals 6 and 8 of Z1) is low (ground). Therefore, the gate is disabled and the resulting output is high (open).

(4) *Detected failure circuit conditions.* A failure occurring in the Airborne Radar Navigation Aid System AN/APN-171 results in a fail indication (+28 volts dc) at pins K (0 volts dc) and F (+28 volts dc) of connector J1. If the Airborne Data Annotation System AN/AYA-10 fails, a fail indication will be received only at pin F of connector J1. In either case, the combined

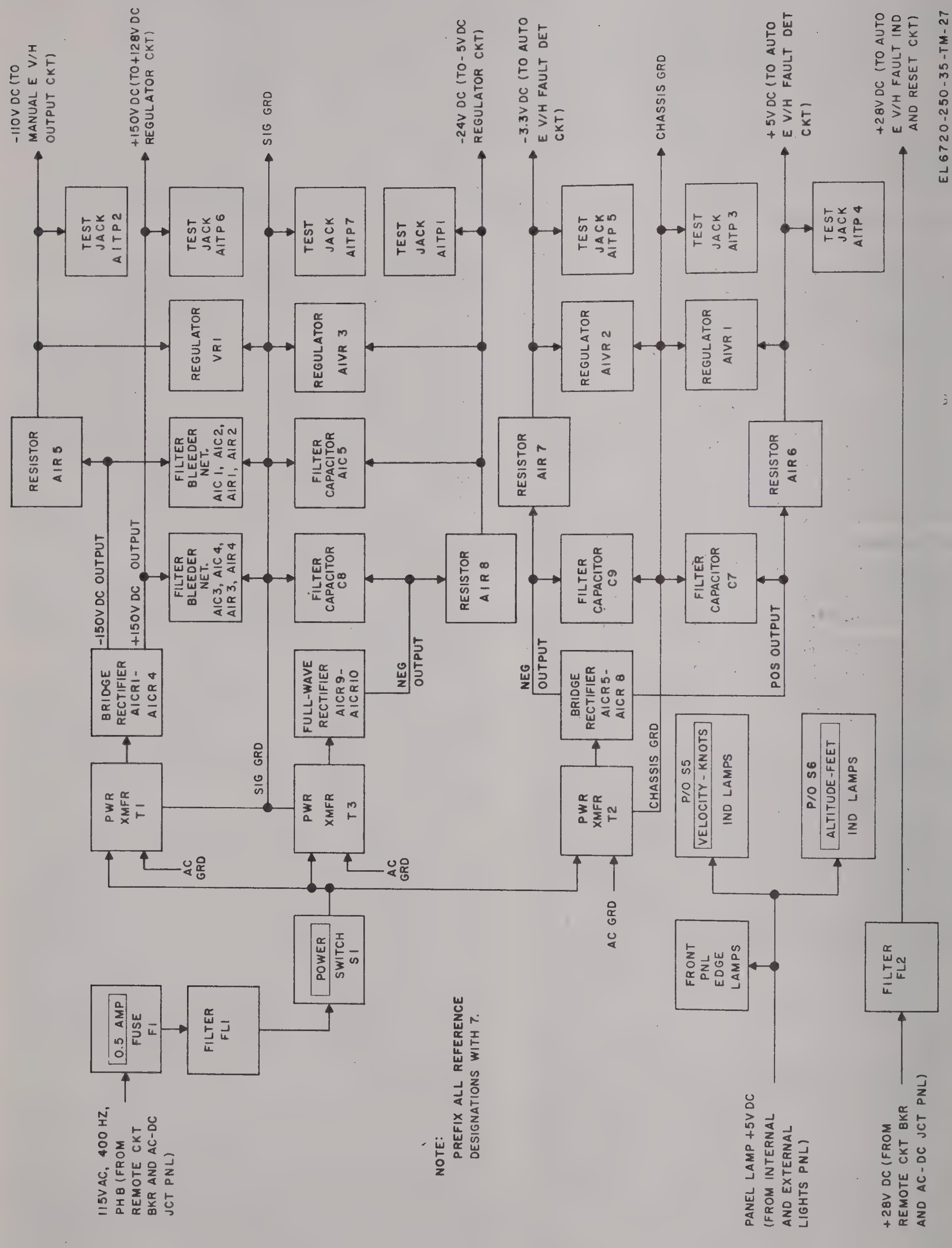


Figure 2-25. Dc power and distribution circuit, block diagram.

utput of inverters Q5 and Q7 will be the same, . low. This results in the same output of the utomatic E V/H fault detector circuit. In the ollowing discussion, it will be assumed that the irborne Radar Navigation Aid System AN/PN-171 has failed.

(*a*) The radar altimeter fail low input at in K of connector J1 is applied through resistor 15, normally-closed contacts of AUTO FAIL EST switch S4, pin D of connector J2 to the input of two series inverters Q6 and Q5. This reults in a low output from the second inverter.

(*b*) The Airborne Data Annotation Sysem AN/AYA-10 fail high input at pin F of onnector J1 is applied through pin J of connecor J2 to the input of inverter Q7 which results n a low output.

(*c*) Since both inverter outputs Q5 and 7 are low, the combined output is low. However, if either inverter output was low while the ther was high, the resultant combined output ould still be low.

(*d*) The low outputs of inverters Q5 and 7 are combined and applied to the toggle input n the flip-flop (terminal 2 of Z2) and to AND gate D input (terminal 9 of Z1). The w at the toggle input causes flip-flop Z2 to hange from the normal "0" state to the "1" tate. When this occurs, the "1" output (terminal 6 of Z2) is high and the "0" output (terminal 9 of Z2) is low. The "0" latch input to the ip-flop (terminal 5 of Z2) remains high beause reset has not been initiated and therefore, oes not affect circuit operation.

(*e*) NAND gate A in Z1 receives a high put (terminal 1 of Z1) from the flip-flop "1" tput (terminal 6 of Z2). The second input erminal 2 of Z1) to NAND gate A is the outt of the free-running multivibrator consisting transistors Q3 and Q4. The multivibrator outt alternates between high and low at an aproximate frequency of 1 Hz. When both inputs NAND gate A are high, the gate output (terinal 3 of Z1) is low; when one input is high d the other input is low, the gate output is gh. Therefore, the output of NAND gate A erminal 3 of Z1) alternates between high and w at an approximate frequency of 1 Hz.

(*f*) NAND gate B in Z1 receives a low put (terminal 12 of Z1) from the flip-flop "0" tput (terminal 9 of Z2). This results in a high tput (terminal 11 of Z1).

(*g*) Both NAND gates A and B outputs erminals 3 and 11 of Z1) are combined and apied to the input of NAND gate C (terminal 4 of Z1). The NAND gate A output is alternating between high and low while NAND gate B output is high. The low is the controlling level when the two outputs are combined. Therefore, the combined output (terminal 4 of Z1) is low when the output of NAND gate A is high.

(*h*) The input to NAND gate C (terminal 4 of Z1) is alternating between high and low at an approximate frequency of 1 Hz. This results in a gate output (terminal 6 of Z1) of an alternating high and low at the same frequency.

(*i*) The low input to NAND gate D (terminal 9 of Z1) from the combined output of inverters Q5 and Q7 results in a high output (terminal 8 of Z1).

(*j*) The outputs of NAND gates C and D are combined and applied to one input of the output NAND gate. NAND gate C output (terminal 6 of Z1) is alternating between high and low while NAND gate D output (terminal 8 of Z1) is high. Since low is the controlling level, the combined outputs of NAND gates C and D alternates between high and low.

(*k*) The alternating high and low (terminals 6 and 8 of Z1) is applied to one input of the output NAND gate. The second input to the output NAND gate is high (+5 volts dc). When both NAND gate inputs are high, the output is low (ground); when one input is high and one input is low, the output is high (open). Therefore, the NAND output is alternating between high (open) and low (ground) at an approximate frequency of 1 Hz.

(5) *Reset circuit conditions.*

(*a*) After a failure occurs in either or both Airborne Radar Navigation Aid System AN/APN-171 and Airborne Data Annotation System AN/AYA-10, a reset can be initiated. Before reset occurs the automatic E V/H fault detector circuit conditions are as described in (4), above. When reset is manually initiated in the automatic E V/H fault indicator and reset circuit, a ground (low) is applied to the "0" latch input on the flip-flop (terminal 5 of Z2) in the automatic E V/H fault detector circuit. The low (ground) at the "0" latch input causes the flip-flop Z2 to change from the "1" state to a "0" state. The flip-flop Z2 will remain in the "0" state as long as the "0" latch input remains grounded. With the flip-flop Z2 in the "0" state, the "1" and "0" outputs and NAND gate A, B and C outputs are the same as described in normal circuit operation with NAND gate C output (terminal 6 of Z1) being high. A low (ground) however, is present at the input to NAND gate D

resulting in a high output (terminal 8 of Z1). The two high outputs (terminals 6 and 8 of Z1) are combined and applied to the output NAND gate. This results in both inputs to the output NAND gate being high. Therefore, the NAND gate output will be a constant low (ground) instead of alternating between high and low as was the condition before reset.

(*b*) When the fail signals at pins K and F of connector J1 return to normal (no failure condition) the automatic E V/H fault indicator circuit returns to normal circuit conditions. If reset has been initiated, the ground at the flip-flop Z2 "0" latch input (terminal 5 of Z2) is removed and the gated output returns to an open circuit.

(6) *Fail test circuit.* The automatic E V/H fault detector circuit contains the AUTO FAIL TEST switch S4. This switch is provided to simulate a failure in the Airborne Radar Navigation Aid System AN/APN-171. When depressed, the switch interrupts the high (+5 volts dc) from pin K of connector J1 to inverter Q6 input causing a high output. The resulting automatic E V/H fault detector circuit conditions are the same as described in (4) above, with the gated output alternating between ground and open. When the AUTO FAIL TEST switch S4 is released, normal circuit conditions return.

c. Automatic E V/H Fault Indicator and Reset Circuit (fig. 2-27).

(1) *General.* The automatic E V/H fault indicator and reset circuit consists of the AUTO FAIL indicator P/O S3, PRESS TO RESET switch P/O S3, lamp dim circuitry, and OVERRIDE switch S2. When the automatic E V/H information to the camera control system fails, AUTO FAIL indicator flashes at an approximate rate of one flash per second. After reset is initiated by momentarily depressing the PRESS TO RESET switch, the AUTO FAIL indicator stops flashing and remains constantly lit. When automatic E V/H information input to camera control system is restored, the AUTO FAIL indicator goes out. The lamp dim circuitry in the automatic E V/H fault indicator and reset circuit, when activated, reduces intensity of the AUTO FAIL indicator. The OVERRIDE switch S2 in MANUAL position causes removal of automatic E V/H information from the camera control system and applies manual E V/H information from the camera control system output circuit. Parts comprising the automatic E V/H fault indicator and reset circuit are located on the front panel and module A5A2 of the manual V/H control panel.

(2) *Indicator and reset circuit operation.* The following ((*a*) thru (*e*) below) describe operation of the AUTO FAIL indicator P/O S3 and the PRESS TO RESET switch P/O S3. It is assumed in the following description that lamp dim relay is deenergized.

(*a*) During normal circuit operation, with automatic E V/H information being applied to the camera control system, +28 volts dc is applied from dc power and distribution circuit (*a* (6) above) to pin E of connector J2, pin E of connector P2, and normally closed contacts (A2 and A3) of reset relay K2, normally closed contacts (B2 and B3) of lamp dim relay K1, pin A of connector P2, pin A of connector J2 to the AUTO FAIL indicator (terminal E). The return for the AUTO FAIL indicator (terminal A) is obtained through pin L of connector J2, pin L of connector P2 from the gated output of the automatic E V/H fault detector circuit. Since the automatic E V/H is being applied to the camera control system, the gated output is open. Therefore, the return path for the AUTO FAIL indicator is open and the indicator is not lit. Reset relay K2 remains deenergized since both sides of the coil (terminals X1 and X2) are open.

(*b*) When a failure occurs in the automatic E V/H input to the camera control system, the gated output from the automatic E V/H fault detector circuit changes from an open to an alternating open-ground condition. This alternating open-ground signal is applied through pin L of connector P2, pin L of connector J2 to AUTO FAIL indicator (terminal A) causing the AUTO FAIL indicator to flash at a rate of approximately once-per-second. The alternating open-ground signal is also applied to one side of the coil (terminal X2) of reset relay K2. However, the reset relay K2 remains deenergized since the other side of the coil (terminal X1) is still open.

(*c*) Reset occurs when PRESS TO RESET switch is momentarily depressed. When depressed, +28 volts dc from the dc power and distribution circuit is applied through normally open contacts (terminals B and D) of PRESS TO RESET switch, pin H of connector 7J2 and pin H of connector P2 to one side of the coil (terminal X1) of reset relay K2. When the alternating open-ground at the other side of the coil (terminal X2) is ground, the relay energizes. With reset relay K2 energized, +28 volts dc is applied through its normally open contacts (A2 and A1), and diode CR4 to its coil (terminal X1) as a self-latching voltage. Normally

NOTES:

1. ARBITRARY GATE DESIGNATIONS A,B,C,D IN Z1 ARE FOR DESCRIPTION PURPOSES ONLY.
2. PREFIX ALL REFERENCE DESIGNATIONS WITH UNIT NUMBER (7) AND SUBASSEMBLY NUMBER (A5 OR A5A2).

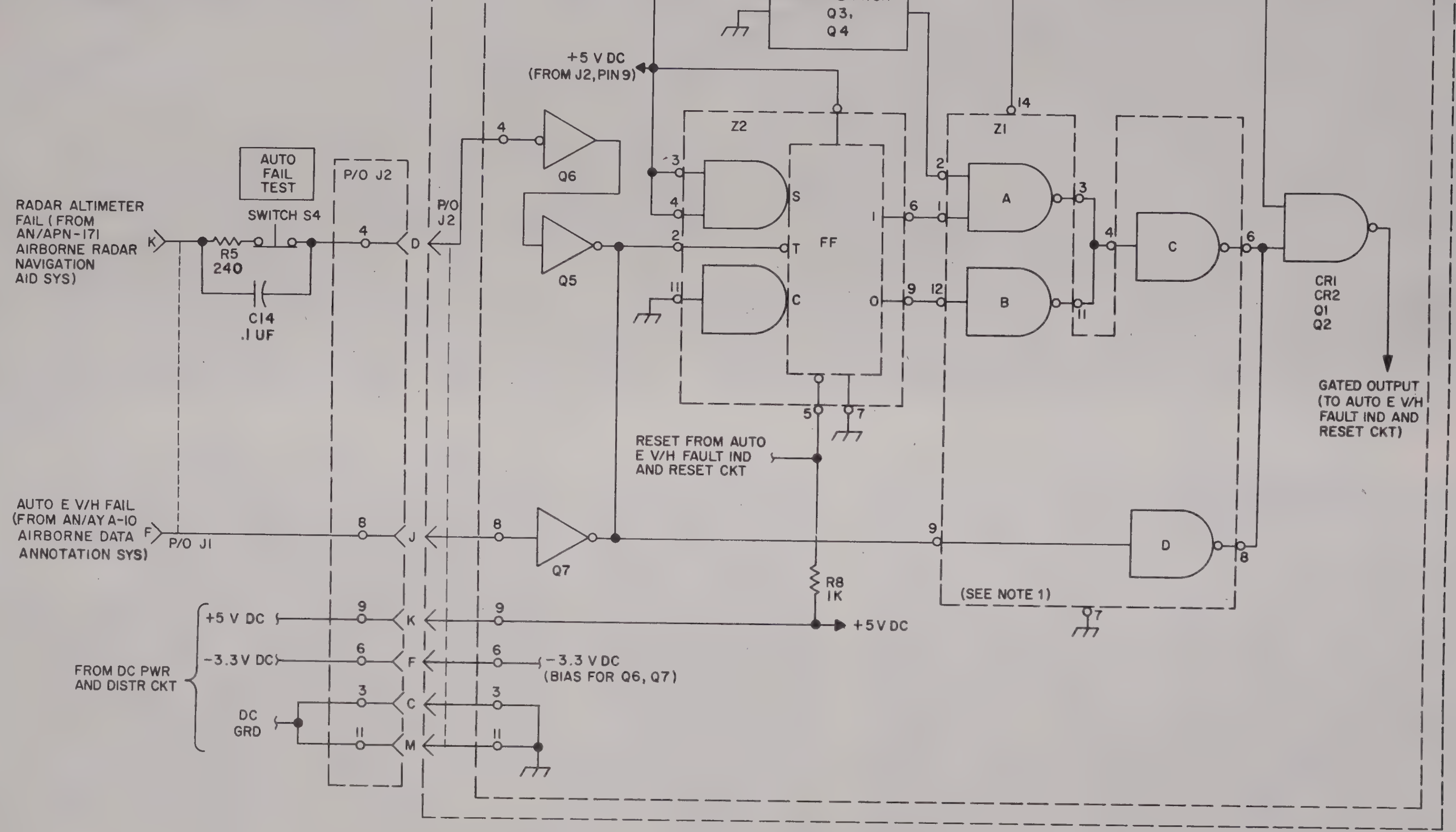


Figure 2–26. Automatic E V/H fault detector, logic and control block diagram.

open contacts (B2 and B1) of reset relay K2 apply a ground to the automatic E V/H fault detector circuit which results in the gated output changing from an alternating open-ground to a constant ground. The constant ground is applied to AUTO FAIL indicator (terminal A) causing the indicator to stop flashing and remain constantly lit. The constant ground is also applied to the coil (terminal X2) of reset relay K2. Reset relay K2 is self-latched through normally-open contacts (A2 and A1). Therefore, when the PRESS TO RESET switch is released, reset relay K2 will remain energized.

(*d*) After reset occurs, +28 volts dc is applied through normally-open contacts (A2 and A1) of reset relay K2, diode CR3, resistor R6, normally closed contacts (B2 and B3) of lamp dim relay K1, pin A of connector P2 and pin A of connector J2 to the AUTO FAIL indicator (terminal E). The addition of resistor R6 in series with the +28 volts dc to the AUTO FAIL indicator causes a reduction in indicator intensity as compared to indicator intensity during flashing.

(*e*) When the automatic E V/H input to the camera control system is restored, the gated output from the automatic E V/H fault detector circuit changes from a ground to an open. When ground is removed, the AUTO FAIL indicator goes out, reset relay K2 deenergizes, and the reset ground to the automatic E V/H fault detector circuit is removed. Therefore, the automatic E V/H fault indicator and reset circuit returns to the normal condition.

(3) *Lamp dim circuitry*. If desired, the intensity of the AUTO FAIL indicator P/O S3 may be reduced while the indicator is either flashing or constantly lit. The dim command (+28 volts dc) from the internal and external lights panel is applied through pin J of connector J1, pin B of connector J2 and pin B of connector P2 to one side of the coil (terminal X1) of lamp dim relay K1. Since chassis ground is connected to the other side of the coil (terminal X2) of lamp dim relay K1 the relay energizes. With lamp dim relay K1 energized, +28 volts dc is applied through normally closed contacts (A2 and A3) of reset relay K2, normally open contacts (B2 and B1) of lamp dim relay K1, resistor R7, pin A of connector P2 and pin A of connector J2 to the AUTO FAIL indicator (terminal E). The addition of series resistor R7 results in a reduced intensity of the AUTO FAIL indicator.

(4) *Manual override circuitry*. OVERRIDE switch S2 allows application of the manual E V/H signal to the camera control system in place of the automatic E V/H signal. When OVERRIDE switch S2 is set to AUTO position, +28 volts dc from the dc power and distribution circuit is applied to pin M of connector J1 as manual E V/H override signal to an external relay. The +28 volts dc causes an external relay to energize if the Airborne Data Annotation System AN/AYA-10 and the Airborne Radar Navigation Aid System AN/APN-171 are properly functioning. When OVERRIDE switch S2 is set to MANUAL position, the +28 volts dc is removed from pin M of connector J1 causing the external relay to deenergize. When deenergized, the external relay applies manual E V/H output circuit at pin E of connector J1 to the camera control system in place of the automatic E V/H signal (fig. 3-2). The AUTO FAIL indicator P/O S3 and fault detector circuitry (fig. 2-27) operates independently of OVERRIDE switch S2. When OVERRIDE switch S2 is placed in MANUAL position, the AUTO FAIL indicator remains off. If a failure occurs in either the Airborne Radar Navigation Aid System AN/APN-171 or Airborne Data Annotation System AN/AYA-10 with OVERRIDE switch S2 in the MANUAL position, the AUTO FAIL indicator will flash.

d. –5 Vdc Regulator Circuit (fig. 3-2).

(1) The –5-volt dc regulator circuit utilizes the –24-volt dc output from the dc power and distribution circuit (*a*(4) above) to provide the manual E V/H output circuit with a regulated –5 volts dc. Regulation is obtained by using an operational amplifier connected as a differential amplifier. Parts comprising the –5-volt dc regulator circuit are located in module A5A3 of the manual V/H control panel.

(2) The –24 volts dc at pin P of connector J2 is applied through terminal 13 of module A5A3 to the (V–) input (terminal 4) of amplifier AR1 and to a voltage divider consisting of resistors R4 and R1, potentiometer R2, and resistor R3. Signal ground at pin T of connector J2 is applied through module A5A3 (terminal 14) to the other end of the voltage divider at resistor R3 and to the (V+) input (terminal 7) of amplifier AR1. Zener diode VR1 maintains a –6.2-volt dc potential across resistor R1, potentiometer R2, and resistor R3 in the voltage divider. The reference voltage for amplifier AR1 is established at the wiper arm of potentiometer R2 and applied to the non-inverting input (terminal 3) of amplifier AR1. Therefore, the output voltage at terminal 12 of the –5-volt dc reg-

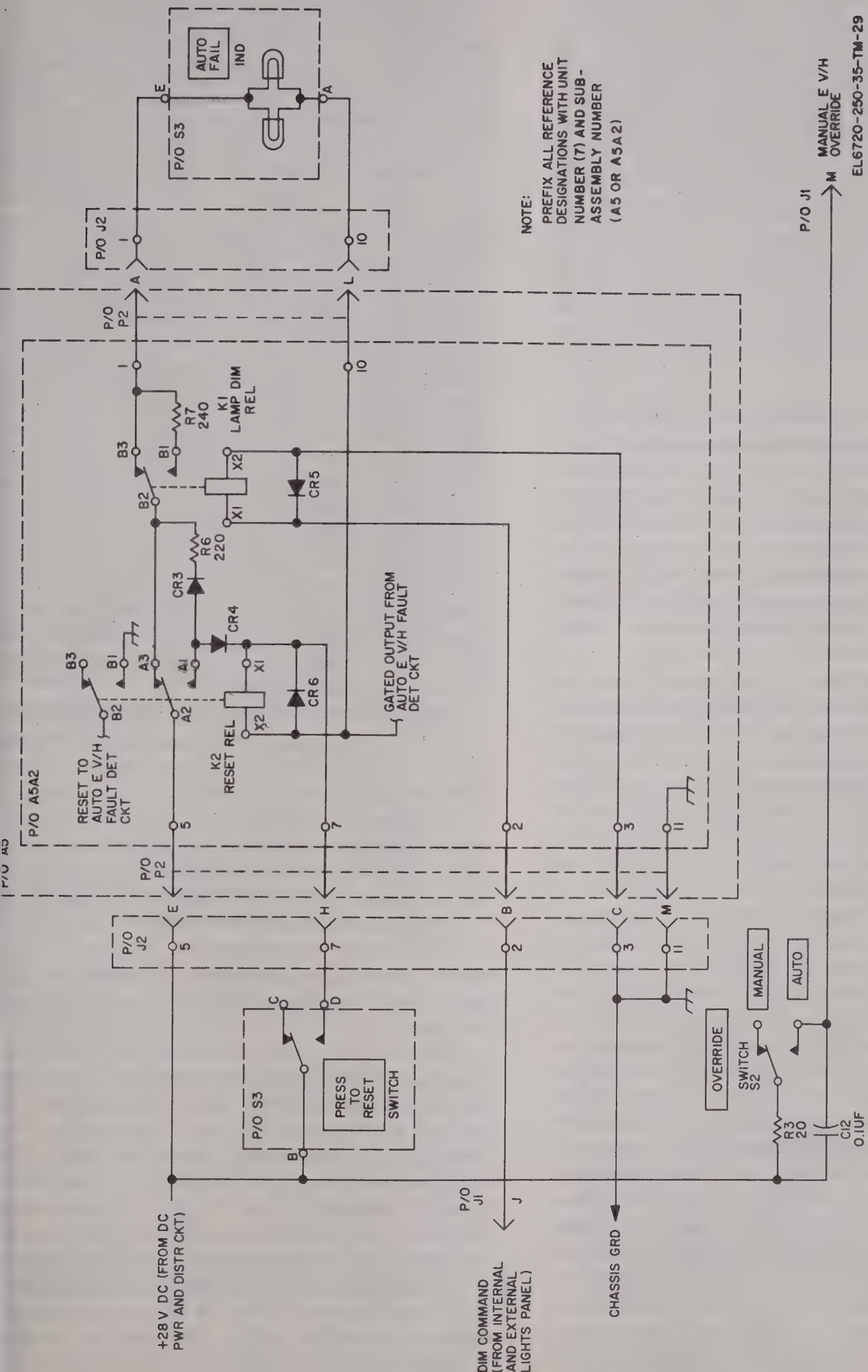


Figure 2-27. Automatic E V/H fault indicator and reset circuit, simplified schematic diagram.

ulator circuit can be varied by adjusting potentiometer R2. The differential voltage for amplifier AR1 is obtained through resistor R6 which is connected between the output (terminal 6) of amplifier AR1 and the differential input (terminal 2) of amplifier AR1. Input frequency compensation is provided by resistor R5 and capacitor C1. Capacitor C2 provides output frequency compensation. In case of a malfunction, extreme regulator output voltages (at terminal 12) are prevented by diodes CR1 and CR2. Diode CR1 limits the negative output voltage by preventing the differential input voltage (terminal 2) of amplifier AR1 from being more negative than the reference voltage of –6.2 volts dc. Diode CR2 prevents the regulator output from going positive.

e. +128 Vdc Regulator Circuit (fig. 3–2).

(1) The +128-volt dc regulator circuit utilizes the +150-volt dc output of the dc power and distribution circuit (*a*(3) above) to provide a regulated +128 volts dc to the manual E V/H output circuit. Regulation is obtained using transistor Q1 as a series regulator and a regulator control AR1. Parts comprising the +128-volt dc regulator circuit are located in module A5A4 of the manual V/H control panel.

(2) The +150-volt dc input, applied through terminal 17 of module A5A4 from the dc power and distribution circuit is applied to the collector of series regulator transistor Q1. The +128 volt dc regulator circuit output (terminal 15) of module A5A4 is obtained from the emitter of transistor Q1 through resistor R6. The dc return (terminal 16) for the +128 volt dc regulator circuit is signal ground. Resistor R6, in series with the regulator circuit output (terminal 15), is the load sensing resistor for regulator control AR1. Changes in the load on the +128 volt dc regulator circuit are reflected by changes in the voltage drop across load sensing resistor R6. These voltage drop changes are processed in regulator control AR1 and result in a corresponding change in the positive regulator control output voltage (terminal 6) of regulator control AR1. The regulator control voltage is applied to the base of series regulator transistor Q1 through sensor diode VR2 as forward bias. Zener diode VR2 prevents application of forward bias to transistor Q1 when the output of the regulator control AR1 is less than +6.2 volts dc.

(3) The various dc voltages required for operation of regulator control AR1, except the V+ voltage (terminal 8) and Vc voltage (terminal 7), are developed across a voltage divider consisting of resistors R3, R2, R4, and R1. Resistor R3, at one end of the voltage divider, is connected to the +128-volt dc regulator circuit output (terminal 15); resistor R1, at the other end of the voltage divider, is connected to signal ground (terminal 16) of module A5A4. In addition to the +128 volts dc across the voltage divider, an output reference voltage (terminal 4) from regulator control AR1 is algebraically summed with the dc voltage present at the junction of resistors R2 and R4. Collector voltage (Vc) (terminal 7) and V+ voltage (terminal 8) for regulator control AR1 are obtained from the +150-volt dc input (terminal 17) of module A5A4 through resistor R5. Zener diode VR1 protects the series regulator transistor Q1 from damage due to an overload condition. If an overload occurs, the +128-volt dc output voltage (terminal 15) of module A5A4 decreases which results in an increased voltage drop across zener diode VR1. When the voltage drop across Zener diode VR1 increases to 33 volts dc, zener diode VR1 conducts and provides a shunt current path around series regulator transistor Q1. The shunt current path between the +150 volts dc input (terminal 17) and the +128-volt dc output (terminal 15) of module A5A4 is through resistor R5 and Zener diode VR1.

f. Manual E V/H Output Circuit (fig. 2–28).

(1) The manual E V/H output circuit generates manual E V/H voltages, ranging from +0.6 volt dc to +100.6 volts dc. The manual E V/H voltage is required by the camera control system when the automatic E V/H fails or is not used. This circuit consists of operational amplifier AR1, the VELOCITY-KNOTS thumbwheel P/O S5, and the ALTITUDE-FEET thumbwheel P/O S6. Parts comprising the manual E V/H output circuit are physically mounted on the chassis and front panel of the manual V/H control panel.

(2) The regulated –110-volt dc input and signal ground from the dc power and distribution circuit (*a*(3) above) are applied to the – input and the differential input (terminal 2), respectively of operational amplifier AR1. The +128 volts dc from the +128-volt dc regulator circuit is applied to the + input of operational amplifier AR1 and test jack TP9. The –5 volts dc from the –5-volt dc regulator circuit is applied to ALTITUDE-FEET thumbwheel and test jack TP8. Potentiometer R1 is the adjustment for operational amplifier AR1. The positive output voltage (terminal 4) from operational amplifier

AR1 is applied to pin E of connector J1 for external use, and to test jack TP10. Reference for the manual E V/H output is signal ground at pin D of connector J1. Diode CR1 prevents the manual E V/H output voltage from going negative. Test jacks TP8 (–5 volts dc), TP9 (+128 volts dc), and TP10 (+E V/H output voltage) are provided to allow monitoring of the manual E V/H output circuit.

(3) The positive output voltage (terminal 4) of operational amplifier AR1 is determined by the settings on the VELOCITY-KNOTS thumbwheel and the ALTITUDE-FEET thumbwheel. The VELOCITY-KNOTS thumbwheel consists of three thumbwheel switches representing velocity in hundreds, tens, and units. The ALTITUDE-FEET thumbwheel consists of five thumbwheel switches representing altitude in ten thousands, thousands, hundreds, tens, and units. Changing a thumbwheel switch setting changes the total resistance of the associated thumbwheel by switching in various fixed values of resistance. Since the input to the VELOCITY-KNOTS thumbwheel is connected to the positive output voltage (terminal 4) operational amplifier AR1, the resultant switch module output voltage will be positive. The ALTITUDE-FEET thumbwheel S6 receives a regulated –5-volt dc input; therefore the resultant switch module output voltage will be negative. The two thumbwheel outputs (one positive, one negative) are algebraically summed and applied to the summing input (terminal 1) on operational amplifier AR1. Under normal circuit conditions, the summed voltage will always be positive. If the VELOCITY-KNOTS thumbwheel setting is increased, the module resistance increases and results in a decrease in the summed voltage. As a result the output voltage (terminal 4) of operational amplifier AR1 will increase. If the ALTITUDE-FEET thumbwheel setting is increased, the module resistance increases and results in a decrease in the summed voltage. As a result the output voltage (terminal 4) of operational amplifier AR1 will decrease.

2–8. Photo System Assembly (Unit 1) Modules

a. Film Drive Amplifier Module 1A2 (fig. 2–29). The film drive amplifier module 1A2 receives a compensated E V/H signal from printed circuit board and component assembly module 1A3 and a –tachometer feedback signal from the camera (Unit 9) and processes these signals to develop sufficient + and – film drive voltage to control the film drive motor in the camera (Unit 9).

(1) Primary input 115-volt, 400-Hz, phase B ac power is applied to the primary winding of

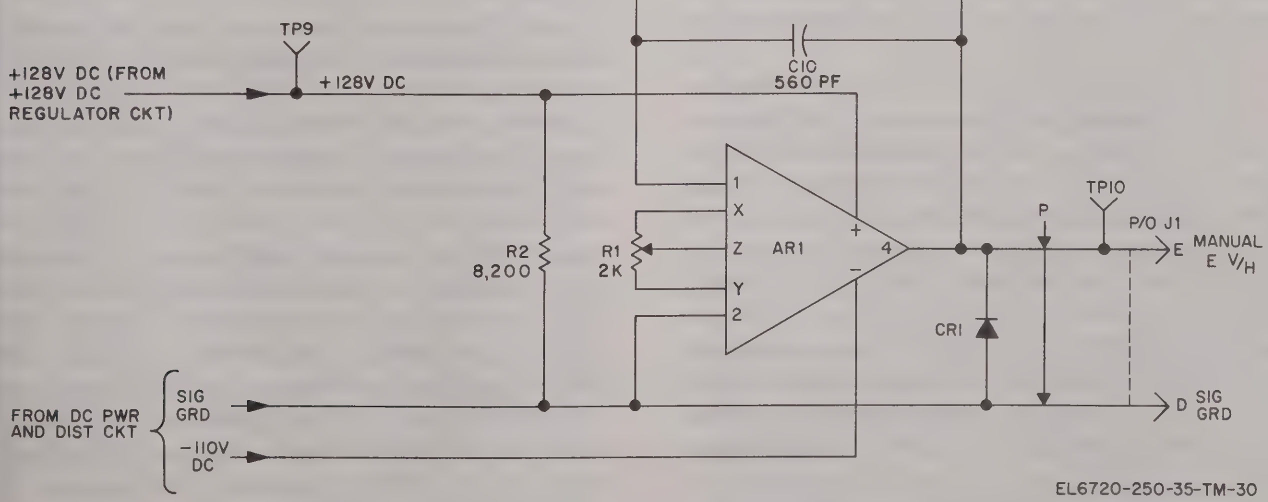


Figure 2–28. Manual E V/H output circuit, simplified schematic diagram.

power transformer T1. The secondary voltage from power transformer T1, is applied to three separate fullwave rectifier circuits consisting of diodes CR1 and CR6, CR2 and CR5, and CR3 and CR4.

(2) Full-wave rectified pulsating positive dc voltage, developed by diodes CR1 and CR6, is filtered by capacitor C2 and applied through resistor R2 to zener diode CR9. Zener diode CR9 produces a regulated +6.2 volts dc which is then applied to the collector of differential transistors A1Q1A and A1Q1B and potentiometer R9. Filtered dc power from capacitor C2 is also applied to the collectors of differential transistors A1-Q2A and A1Q2B and the emitters of transistors Q1 and Q2. Full wave rectified pulsating negative dc voltage developed by diodes CR3 and CR4 is filtered by capacitor C3 and applied through resistor R7 to zener diode CR10. Zener diode CR10 produces a regulated –6.2 volts dc which is then applied to emitters of differential transistors A1Q1A, A1Q1B, A1Q2A and A1Q2B.

(3) The compensated E V/H signal from the printed circuit board and component assembly module 1A3 is applied to the base of differential amplifier transistor A1Q1A. A –tachometer feedback signal from the camera (Unit 9) is applied through resistor R17, to the base of transistor A1Q1A. The junction of resistor R17, base of transistor A1Q1A and diodes CR11 and CR12 serves as a summing point for the applied compensated E V/H signal and –tachometer feedback signal. Diodes CR11 and CR12 function to limit the algebraically summed signal level such that differential amplifier A1Q1A is not overdriven.

(4) A bias voltage is applied to the base of transistor A1Q1A, is supplied by potentiometer R9.

(5) The algebraic sum of the compensated E V/H signal and the –tachometer feedback signal, when positive, causes increased conduction in transistor A1Q1A which in turn results in decreased conduction in transistor A1Q1B since both transistors are common emitter coupled. Decreased conduction in transistor A1Q1B results in an increased conduction in transistor A1Q2A.

(6) Decreased current conduction in transistor A1Q2B causes a decreased conduction in transistor Q1. Increased conduction in transistor A1Q2A results in an increased conduction in transistor Q2.

(7) Increased current through transistor Q2 causes capacitor C4 to charge through the transistor towards the positive dc power source. When the charge developed across capacitor C4 is of sufficient magnitude, unijunction transistor conducts, thereby producing a current pulse through the primary winding of pulse transformer A2T1.

(8) Pulse power, developed in the primary winding of pulse transformer A2T1, is coupled across resistors A2R1 and A2R2 (fig. 3-11) to the gate and cathode leads of silicon control rectifiers A2Q2 and A2Q1 respectively. Resistors A2R1 and A2R2 provide an impedance match between the transformer secondary windings and the low impedance input of the silicon rectifiers.

(9) Application of a positive signal to the gate and a negative signal to the cathode causes each silicon control rectifier to conduct whenever its anode is positive or its cathode is negative. When a reverse voltage, developed by rectifier diodes A2CR1 and A2CR2 (fig. 2-29), is of sufficient magnitude and polarity (negative to anode of A2Q2 and positive to cathode of A2-Q1), conduction ceases in both silicon control rectifiers.

Figure 2-29. Film drive amplifier module 1A2, block diagram.

[Located in back of manual]

b. Intervalometer Module 1A1 (fig. 2-30). Intervalometer module 1A1 processes an operate ground input and a compensated E V/H signal to produce a cycle pulse signal for camera operation. The amplitude and width of the cycle pulse are constant while the pulse repetition frequency is determined by the magnitude of the compensated E V/H input signal. When the compensated E V/H signal is high, the pulse repetition frequency of the cycle pulse train is high and vice versa.

(1) Primary 115-volt ac, 400-Hz, phase B power is applied to a power supply which consists of diodes CR1 and CR12 which operate as a halfwave rectifier. Pulsating halfwave rectified power is filtered by capacitors C1 and C5. Positive filtered +153 volts dc from the junction of filter capacitor C1 and diode CR1 is applied to resistor R1 while negative filtered –153 volts dc from the junction of filter capacitor C5 and diode CR12 is applied to resistor R20. Zener diode CR2 and resistor R1, connected in series, function to regulate the applied +153 volts dc to a +39-volt dc level. This regulated +39-volt dc power is applied through resistor R2 to zener diode A1CR1 which regulates the voltage to a +6.2-volt dc level. Resistors R1 and R2 act as current limiters for Zener diodes CR2 and A1-

CR1 respectively. Diode CR10 and Zener diode CR7 are connected in series with resistor R20 and produce –37.8-volt dc and –37.2-volt dc output power. Negative 37.8-volt dc power is applied to resistor R8 and zener diode A1CR4 to produce regulated –6.2-volt dc power.

(2) Camera dc +28 volts is applied through diodes CR16 and CR9 to one side of the coil of operate relay K1 and the emitter of pulse generator transistor Q2, respectively. Camera dc +28 volts is also applied to one side of thermistor A1RT1.

(3) An operate ground signal from the photo control panel (Unit 3) is applied to the other side of the coil of operate relay K1, energizing the relay and enabling operation of intervalometer module 1A1.

(4) The compensated E V/H signal is applied directly to the base of differential amplifier transistor A1Q4A. Diodes A1CR2 and A1CR3 clamp the incoming compensated E V/H signal to a maximum positive and negative level such that the differential amplifier is not overdriven.

(5) A positive E V/H signal input causes conduction within transistor A1Q4 to increase, thereby decreasing conduction within transistors A1Q3A and A1Q4B. Decreased conduction in transistor A1Q4B causes an increased conduction through transistor A1Q3B. Transistors A1Q3A and A1Q3B function as a second differential amplifier. Resistors A1R3 and A1R4 are the load resistors to the collectors for transistors A1Q3A and A1Q3B respectively, while resistor A1R12 is the common lead for the emitters of both transistors.

(6) Decreased conduction in transistor A1Q3A results in decreased conduction in transistor A1Q1. Increased conduction in transistor A1Q3B results in increased conduction in transistor A1Q2.

(7) When the negative-going portion of transistor amplifier A1Q2 output signal is applied to the series network consisting of zener diode CR4 and resistor R4, Zener diode CR4 breakdown occurs, thereby applying a reduced positive voltage to the base of transistor Q1. When the positive-going portion of the transistor amplifier A1Q2 output signal is applied to the series network consisting of Zener diode CR4 and series resistor R4, Zener diode CR4 conduction does not occur and transistor amplifier Q1 is cut off.

(8) During the time that transistor amplifier Q1 is nonconducting, an integrating compensation capacitor 1C1 (located within the circuitry in the photo system assembly (Unit 1)), functions in conjunction with transistor amplifier Q1 to form a saw-tooth voltage generator, which is sensed by threshold diode CR13 to control the one-shot multivibrator comprised of transistors Q4 and Q6.

(9) When a positive E V/H signal is applied, integrating compensation capacitor 1C1 charges in a linear manner through a network consisting of diode CR6 and resistor R26, to the –153-volt dc power source and back to one side of the capacitor. When transistor Q1 conducts, the integrating compensation capacitor 1C1 discharges through the conducting transistor Q1 and a parallel connected network consisting of resistor R5 and capacitor C3. The negative saw-tooth voltage waveform, developed at the junction of resistor R5 and the collector of transistor Q1, causes zener diode CR6 to break down, developing a reduced amplitude negative saw-tooth voltage waveform across resistor R26.

(10) This negative polarity saw-tooth voltage is applied through resistor R22 and diode CR14 to four-layer threshold diode CR13. Application of this voltage causes break-down of CR13 which produces a negative pulse that is applied to the one-shot multivibrator. The quiescent state of operation of the one-shot multivibrator is as follows:

(*a*) Transistor Q6 is conducting at saturation due to the forward bias applied through resistor R24.

(*b*) Conduction of transistor Q6 provides reverse bias to transistor Q4 through resistor R15, thereby preventing transistor Q4 conduction. With transistor Q6 conducting and transistor Q4 nonconducting, capacitor C6 charges up to approximately –37.8 volts dc through the external load to ground, then up through the emitter and base of conducting transistor Q6 and diode CR11 to one side of capacitor C6.

(11) When a negative polarity pulse is applied to the base of transistor Q6, transistor conduction decreases, thereby causing its collector to become less negative. The less negative collector voltage is then coupled through resistor R15 to the base of transistor Q4, thereby causing transistor conduction. This action instantaneously places approximately –74 volts dc across capacitor C6. Simultaneously, diode CR11 continues to conduct until the anode goes from –36 volts dc to –38 volts dc at which time the diode stops conducting, thereby blocking the base current of transistor Q6 and preventing conduction. With

transistor Q6 nonconducting, capacitor C6 starts to discharge through transistor Q4 toward -37.8 volts dc to ground, and up through thermistor RT1 and resistor R14 to the other side of capacitor C6. The pulse width is determined by the RC time constant (R14 and C6) during discharge of capacitor C6.

(12) As soon as capacitor C6 is discharged, transistor Q6 is allowed to conduct, thereby preventing transistor Q4 from conducting. In this condition, the multivibrator has returned to its quiescent state; it is held in readiness for the application of another negative trigger pulse input, and an output positive-going square wave signal is present at the collector of transistor Q4.

(13) When the negative-going portion of the output signal is present, zener diode CR15 breakdown occurs and produces a negative-going signal voltage across resistor R19. This negative-going voltage causes transistor Q3 to conduct, thereby developing a negative-going pulse across resistor R17. The negative-going pulse, developed across resistor R17, causes transistor Q2 to conduct, thereby producing a positive polarity output voltage (cycle pulse), which is applied to the camera (Unit 9).

(14) The negative square wave signal voltage, present at the collector of transistor Q6, is applied to the base of reset amplifier transistor Q5. As a result of the applied negative square wave signal, transistor Q5 is alternately nonconducting and conducting, thereby producing an unsymmetrical negative square wave output signal. Each time transistor Q5 conduction occurs, capacitor 1C1 discharges through variable resistor R21 and resistors R12, R9 and R6 and automatically resets the integrator output to zero. The integration operation then starts over.

(15) When operate relay K1 is deenergized, relay contacts open the emitter circuit of transistor Q4, thereby disabling generation of cycle pulses. This action creates a steady state negative voltage as a direct result of transistor Q5 conducting heavily. The resultant negative voltage is applied to the base of transistor amplifier A1Q4A and across diode A1CR3. Application of this negative voltage nullifies the effect of incoming positive compensated E V/H signal.

(16) When the negative-going portion of multivibrator transistor square wave signal output waveform is applied as feedback to the input of differential amplifier A1Q4A, diode A1CR3 effectively clamps the signal to ground. The summed signal, present at the base of transistor A1Q3A, appears as a very low amplitude square wave having a negative-going portion whose width is dependent upon the multivibrator output square wave signal.

Figure 2-30. Intervalometer module 1A1, block diagram.
[Located in back of manual]

c. PC Board and Component Assembly Module 1A3 (fig. 2-31). The PC board and component assembly module 1A3 supplies the power required to operate the vertical or oblique camera doors, and rotary mount actuator (Unit 2). The assembly is designed with an auxiliary circuit which consists of relays and resistor networks. The auxiliary circuit is used to apply a resistance to the applied system E V/H input to compensate for depression angle and focal length of various lens cones used with the camera, and thereby provides a compensated E V/H output to the intervalometer module 1A1 and film drive amplifier module 1A2.

(1) *Camera dc +28 volts.* The camera dc +28 volts is applied to one side of the coils of LA-370A (1 3/4 inch) relay K7, LA-317A (3 inch) relay K6, ANY 30° relay K1, ANY 15° relay K2, LA-372A (12 inch) relay K5, ANY 30° relay K3 and ANY 15° relay K4.

(2) *LA-374A (6-inch lens cone) in 90° position.* When the LA-374A (6-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to 90° position, circuit operation is as follows:

(*a*) *Camera dc +28 volts.* Camera dc +28 volts is applied through the normally closed contacts of the LA-370A (1 3/4 inch) relay K7 to one side of the coils of 30° left relay K8, 30° right relay K9, 15° left relay K10 and 15° right relay K11.

(*b*) *Mount vertical voltage (error signal).* The mount vertical voltage (error signal) is applied through the normally-closed contacts of 30° left relay K8, normally-closed contacts of 30° right relay K9, normally-closed contacts of 15° left relay K10, normally-closed contacts of 15° right relay K11 and pin 36 of connector 1AX3 to the rotary mount actuator (Unit 2), as mount position (error) signal.

(*c*) *Mount 115-volt ac, 400-Hz, phase C power.* The mount 115-volt ac, 400-Hz, phase C power is applied through the normally-closed contacts of LA-370A (1 3/4 inch) relay K7 and pin 9 of connector 1XA3 to the rotary mount actuator (Unit 2), as mount 115 volts ac, 400 Hz.

(*d*) *System E V/H signal.* The system E V/H signal is applied to two circuits as follows:

to the intervalometer module 1A1 as compensated E V/H signal through normally-closed contacts of LA–370A (1 3/4 inch) relay K7, normally-closed contacts of LA–371A (3 inch) relay K6, normally-closed contacts of LA–372A (12 inch) relay K5, focal length and depression angle resistor R12, normally-closed contacts of ANY 30° relay K3, normally-closed contacts of ANY 15° relay K4 and pin 31 of connector 1XA3, and (2) to the film drive amplifier module 1A2 as compensated E V/H signal through normally-closed contacts of LA–370A (1 3/4 inch) relay K7, normally-closed contacts of LA–371A (3 inch) relay K6, normally-closed contacts of LA–372A (12 inch) relay K5, focal length and depression angle resistor R2, normally closed contacts of ANY 30° relay K1, normally-closed contacts of ANY 15° relay K2, and pin 1 of connector 1XA3.

(*e*) *Camera door +28 volts dc.* The camera door +28 volts dc is applied through normally-closed contacts of 30° left relay K8, normally closed contacts of 30° right relay K9, normally-closed contacts of 15° left relay K10, normally-closed contacts of 15° right relay K11 and pin 33 of connector 1XA3 to the vertical camera door actuator relay 8K4 in the photo junction panel (Unit 8), as vertical door open power.

(3) *LA–374A (6-inch lens cone) in L 15° position.* When the LA–374A (6-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to L15° position, circuit operation is as follows:

(*a*) *Camera dc +28 volts.* Camera dc +28 volts is applied in the same manner as mentioned for LA–374A in 90° position ((2)(*a*) above).

(*b*) *Mount switch 15°L (ground) signal.* The mount switch 15°L (ground) signal is applied to the other side of the coil of 15° left relay K10, thereby energizing the relay. With 15° left relay K10 energized, circuit operation is as follows: the mount 15° left voltage (error signal) is applied through normally-open contacts of 15° left relay K10, normally-closed contacts of 15° right relay K11 and pin 36 of connector 1XA3 to the rotary mount actuator (Unit 2), as mount position (error) signal, the camera door +28 volts dc is applied through normally-closed contacts of 30° left relay K8, normally-closed contacts of 30° right relay K9, normally-open contacts of 15° left relay K10 and pin 20 of connector 1XA3 to the left camera door actuator relay 8K3 in the photo junction panel (Unit 8), as the left door open power and chassis ground is applied through normally-open contacts of 15° left relay K10 to the other side of the coils of ANY 15° relays K2 and K4, thereby energizing both relays.

(*c*) *Mount 115-volt ac, 400-Hz, phase C power.* Mount 115-volt ac, 400-Hz, phase C power is applied in the same manner as mentioned for LA–374A in 90° position ((2)(*c*) above).

(*d*) *System E V/H signal.* The system E V/H signal is applied to two circuits as follows: to the intervalometer module 1A1 as compensated E V/H signal through normally-closed contacts of LA–370A (1 3/4 inch) relay K7, normally-closed contacts of LA–371A (3 inch) relay K6, normally-closed contacts of LA–372A (12 inch) relay K5, focal length and depression angle resistor R18, normally-open contacts of ANY 15° relay K4 and pin 31 of connector 1XA3, and to the film drive amplifier module 1A2 as compensated E V/H signal through normally-closed contacts of LA–370A (1 3/4 inch) relay K7, normally-closed contacts of LA–371A (3 inch) relay K6, normally-closed contacts of LA–372A (12 inch) relay K5, focal length and depression angle resistor R8, normally-open contacts of ANY 15° relay K2 and pin 1 of connector 1XA3.

(4) *LA–374A (6-inch lens cone) in R15° position.* When the LA–374A (6-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to R15° position, circuit operation is as follows:

(*a*) *Camera dc +28 volts.* Camera dc +28 volts is applied in the same manner as mentioned for LA–374A in 90° position ((2) (*a*) above).

(*b*) *Mount switch 15°R (ground) signal.* The mount switch 15°R (ground) signal is applied to the other side of the coil of 15° right relay K11, thereby energizing the relay. With 15° right relay K11 energized, circuit operation is as follows: the mount 15° right voltage (error signal) is applied through normally open contacts of 15° right relay K11 and pin 36 of connector 1XA3 to the rotary mount actuator (Unit 2), as mount position (error) signal, the camera door +28 volts dc is applied through normally-closed contacts of 30° left relay K8, normally-closed contacts of 30° right relay K9, normally-closed contacts of 15° left relay K10, normally open contacts of 15° right relay K11 and pin 32 of connector 1XA3 to the right camera door actuator relay 8K2 in the photo junction panel (Unit 8), as the right door open power,

and (3) chassis ground is applied through normally-open contacts of 15° right relay K11 to the other side of the coils of ANY 15° relays K2 and K4, thereby energizing both relays.

(c) *Mount 115-volt ac, 400-Hz, phase C power.* Mount 115-volt ac, 400-Hz, phase C power is applied in the same manner as mentioned for LA–374A in 90° position ((2)(c) above).

(d) *System E V/H signal.* The system E V/H signal is applied in the same manner as mentioned for LA–374A in L15° position ((3)(d) above).

(5) *LA–374A (6-inch lens cone) in L30° position.* When the LA–374A (6-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to L30° position, circuit operation is as follows:

(a) *Camera dc +28 volts.* Camera dc +28 volts is applied in the same manner as mentioned for LA–374A in 90° position ((2)(a) above).

(b) *Mount switch 30°L (ground) signal.* The mount switch 30°L (ground) signal is applied to the other side of the coil of 30° left relay K8, thereby energizing the relay. With 30° left relay K8 energized, circuit operation is as follows: the mount 30° left voltage (error signal) is applied through normally-open contacts of 30° left relay K8, normally-closed contacts of 30° right relay K9, normally-closed contacts of 15° left relay K10, normally-closed contacts of 15° right relay K11 and pin 36 of connector 1XA3 to the rotary mount actuator (Unit 2), as mount position (error) signal; the camera door +28 volts dc is applied through normally-open contacts of 30° left relay K8 and pin 20 of connector 1XA3 to the left camera door actuator relay 8K3 in the photo junction panel (Unit 8), as the left door open power; and chassis ground is applied through normally-open contacts of 30° left relay K8 to the other side of the coils of ANY 30° relays K1 and K3, thereby energizing both relays.

(c) *Mount 115-volt ac, 400-Hz, phase C power.* Mount 115-volt ac, 400-Hz, phase C power is applied in the same manner as mentioned for LA–374A in 90° position ((2)(c) above).

(d) *System E V/H signal.* The system E V/H signal is applied to two circuits as follows: to the intervalometer module 1A1 as compensated E V/H signal through normally-closed contacts of LA–370A (1 3/4 inch) relay K7, normally-closed contacts of LA–371A (3 inch) relay K6, normally-closed contacts of LA–372A (12 inch) relay K5, focal length and depression angle resistor R11, normally-open contacts of ANY 30° relay K3, normally-closed contacts of ANY 15° relay K4 and pin 31 of connector 1XA3; and to the film drive amplifier module 1A2 as compensated E V/H signal through normally-closed contacts of LA–370A (1 3/4 inch) relay K7, normally-closed contacts of LA–371A (3 inch) relay K6, normally-closed contacts of LA–372A (12 inch) relay K5, focal length and depression angle resistor R1, normally-open contacts of ANY 30° relay K1, normally-closed contacts of ANY 15° relay K2, and pin 1 of connector 1XA3.

(6) *LA–374A (6-inch lens cone) in R30° position.* When the LA–374A (6-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to R30° position, circuit operation is as follows:

(a) *Camera dc +28 volts.* Camera dc +28 volts is applied in the same manner as mentioned for LA–374A in 90° position ((2)(a) above).

(b) *Mount switch 30°R (ground) signal.* The mount switch 30°R (ground) signal is applied to the other side of the coil of 30° right relay K9, thereby energizing the relay. With 30° right relay K9 energized, circuit operation is as follows: the mount 30° right voltage (error signal) is applied through normally-open contacts of 30° right relay K9, normally-closed contacts of 15° left relay K10, normally-closed contacts of 15° right relay K11, and pin 36 of connector 1XA3 to the rotary mount actuator (Unit 2), as mount position (error) signal; the camera door +28 volts dc is applied through normally-closed contacts of 30° left relay K8, normally-open contracts of 30° right relay K9 and pin 32 of connector 1XA3 to the right camera door actuator relay 8K2 in the photo junction panel (Unit 8), as the right door open power; and chassis ground is applied through normally-open contacts of 30° right relay K9 to the other side of the coils of ANY 30° relays K1 and K3, thereby energizing both relays.

(c) *Mount 115-volt ac, 400-Hz, phase C power.* Mount 115-volt ac, 400-Hz, phase C power is applied in the same manner as mentioned for LA–374A in 90° position ((2)(c) above).

(d) *System E V/H signal.* The system E V/H signal is applied in the same manner as mentioned for LA–374A in L30° position ((5)(d) above).

(7) *LA–370A (1 3/4-inch lens cone) in 90° position.* When the LA–370A (1 3/4-inch lens cone) is installed and the MOUNT switch 3S2

on the photo control panel (Unit 3) is set to 90° position, circuit operation is as follows:

NOTE

The LA-370A is used only in the 90° (vertical) position.

(*a*) *LA-370A (1 3/4 inch) focal length ground.* The LA-370A (1 3/4 inch) focal length ground is applied to the other side of the coil of LA-370A (1 3/4 inch) relay K7, thereby energizing the relay. With LA-370A (1 3/4 inch) relay K7 energized, circuit operation is as follows: the camera dc +28 volts is removed from one side of the coils of 30° left relay K8, 30° right relay K9, 15° left relay K10 and 15° right relay K11; the mount 115-volt ac, 400-Hz, phase C power is removed from the rotary mount actuator (Unit 2) through pin 9 of connector 1XA3; and the system E V/H signal is applied through normally-open contacts of LA-370A (1 3/4 inch) relay K7, focal length and depression angle resistor R7 and pin 1 of connector 1XA3 to the film drive amplifier module 1A2, as compensated E V/H signal. In addition, E V/H signal is applied through the normally open contacts of LA-370A (1 3/4 inch) relay K7, focal length and depression angle resistor R17 and pin 31 of connector 1XA3 to the intervalometer module 1A1, as compensated E V/H signal.

(*b*) *Camera door +28 volts dc.* The camera door +28 volts dc is applied in the same manner as mentioned for LA-374A in 90° position ((2)(*e*) above).

(8) *LA-371A (3-inch lens cone) in 90° position.* When the LA-371A (3-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to 90° position, the operation is the same as mentioned for LA-374A in 90° position ((2) above), except that the LA-371A (3 inch) focal length ground is applied to the other side of the coil of LA-371A (3 inch) relay K6, thereby energizing the relay. With LA-371A (3 inch) relay K6 energized, the system E V/H signal is applied as follows:

(*a*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-open contacts of LA-371A (4 inch) relay K6, focal length and depression angle resistor R15 normally-closed contacts of ANY 30° relay K3, normally-closed contacts of ANY 15° relay K4 and pin 31 of connector 1XA3 to the intervalometer module 1A1, as compensated E V/H signal.

(*b*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-open contacts of LA-371A (3 inch) relay K6, focal length and depression angle resistor R5, normally-closed contacts of ANY 30° relay K1, normally-closed contacts of ANY 15° relay K2 and pin 1 of connector 1XA3 to the film drive amplifier module 1A2, as compensated E V/H signal.

(9) *LA-371A (3-inch lens cone) in L15° position.* When the LA-371A (3-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to L15° position, the operation is the same as mentioned for LA-374A in L15° position ((3) above), except that the LA-371A (3 inch) focal length ground is applied to the other side of the coil of LA-371A (3 inch) relay K6, thereby energizing the relay. With LA-371A (3 inch) relay K6 energized, the system E V/H signal is applied as follows:

(*a*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-open contacts of LA-371A (3 inch) relay K6, focal length and depression angle resistor R19, normally-open contacts of ANY 15° relay K4 and pin 31 of connector 1XA3 to the intervalometer module 1A1, as compensated E V/H signal.

(*b*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-open contacts of LA-371A (3 inch) relay K6, focal length and depression angle resistor R9, normally-open contacts of ANY 15° relay K2 and pin 1 of connector 1XA3 to the film drive amplifier module 1A2, as compensated E V/H signal.

(10) *LA-371A (3-inch lens cone) in R15° position.* When the LA-371A (3-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to R15° position, the operation is the same as mentioned for LA-374A in R15° position ((4) above), except for the system E V/H signal. System E V/H signal application is the same as mentioned for LA-371A in L15° position ((9)(*a*) and (*b*) above).

(11) *LA-371A (3-inch lens cone) in L30° position.* When the LA-371A (3-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to L30° position, the operation is the same as mentioned for LA-374A in L30° position ((5), above), except that the LA-371A (3 inch) focal length ground is applied to the other side of the coil of LA-371A (3 inch) relay K6, thereby energizing the relay. With LA-371A (3 inch) relay K6 energized, the system E V/H signal is applied as follows:

(*a*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-open

contacts of LA-371A (3 inch) relay K6, focal length and depression angle resistor R14, normally-open contacts of ANY 30° relay K3, normally closed contacts of ANY 15° relay K4 and pin 31 of connector 1XA3 to the intervalometer module 1A1, as compensated E V/H signal.

(*b*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-open contacts of LA-371A (3 inch) relay K6, focal length and depression angle resistor R4, normally-open contacts of ANY 30° relay K1, normally-closed contacts of ANY 15° relay K2 and pin 1 of connector 1XA3 to the film drive amplifier module 1A2, as compensated E V/H signal.

(12) *LA-371A (3-inch lens cone) in R30° position.* When the LA-371A (3-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to R30° position, the operation is the same as mentioned for LA-374A in R30° position ((6) above), except for the system E V/H signal. System E V/H signal application is the same as mentioned for LA-371A in L30° position ((11) (*a*) and (*b*) above).

(13) *LA-372A (12-inch lens cone) in 90° position.* When the LA-372A (12-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to 90° position, the operation is the same as mentioned for LA-374A in 90° position ((2) above), except that the LA-372A (12 inch) focal length ground is applied to the other side of the coil of LA-372A (12 inch) relay K5, thereby energizing the relay. With LA-372A (12 inch) relay K5 energized, the system E V/H signal is applied as follows:

(*a*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-closed contacts of LA-371A (3 inch) relay K6, normally-open contacts of LA-372A (12 inch) relay K5, focal length and depression angle resistor R13, normally-closed contacts of ANY 30° relay K3, normally-closed contacts of ANY 15° relay K4 and pin 31 of connector 1XA3 to the intervalometer module 1A1, as compensated E V/H signal.

(*b*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-closed contacts of LA-371A (3 inch) relay K6, normally-open contacts of LA-372A (12 inch) relay K5, focal length and depression angle resistor R3, normally-closed contacts of ANY 30° relay K1, normally-closed contacts of ANY 15° relay K2 and pin 1 of connector 1XA3 to the film drive amplifier module 1A2, as compensated E V/H signal.

(14) *LA-372A (12-inch lens cone) in L15° position.* When the LA-372A (12-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to L15° position, the operation is the same as mentioned for LA-374A in L15° position ((3) above), except that the LA-372A (12 inch) focal length ground is applied to the other side of the coil of LA-372A (12 inch) relay K5, thereby energizing the relay. With LA-372A (12 inch) relay K5 energized, the system E V/H signal is applied as follows:

(*a*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-closed contacts of LA-371A (3 inch) relay K6, normally-open contacts of LA-372A (12 inch) relay K5, focal length and depression angle resistor R20, normally-open contacts of ANY 15° relay K4 and pin 31 of connector 1XA3 to the intervalometer module 1A1, as compensated E V/H signal.

(*b*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-closed contacts of LA-371A (3 inch) relay K6, normally-open contacts of LA-372A (12 inch) relay K5, focal length and depression angle resistor R10, normally-open contacts of ANY 15° relay K2 and pin 1 of connector 1XA3 to the film drive amplifier module 1A2, as compensated E V/H signal.

(15) *LA-372A (12-inch lens cone) in R15° position.* When the LA-372A (12-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to R15° position, the operation is the same as mentioned for LA-374A in R15° position ((4) above), except for the system E V/H signal. System E V/H signal application is the same as mentioned for LA-372A in L15° position ((14) (*a*) and (*b*) above).

(16) *LA-372A (12-inch lens cone) in L30° position.* When the LA-372A (12-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to L30° position, the operation is the same as mentioned for LA-374A in L30° position ((5) above), except that the LA-372A (12 inch) focal length ground is applied to the other side of the coil of LA-372A (12 inch) relay K5, thereby energizing the relay. With LA-372A (12 inch) relay K5 energized, the system E V/H signal is applied as follows:

(*a*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-closed contacts of LA-371A (3 inch) relay K6, normally-open contacts of LA-372A (12 inch) relay K5, focal length and depression angle resistor R16, normally-open contacts of ANY 30° relay K3, normally-closed contacts of ANY 15° relay K4 and pin 31 of connector 1XA3 to the intervalometer module 1A1 as compensated E V/H signal.

(*b*) Through normally-closed contacts of LA-370A (1 3/4 inch) relay K7, normally-closed contacts of LA-371A (3 inch) relay K6, normally-open contacts of LA-372A (12 inch) relay K5, focal length and depression angle resistor R6, normally-open contacts of ANY 30° relay K1, normally-closed contacts of ANY 15° relay K2 and pin 1 of connector 1XA3 to the film drive amplifier module 1A2, as compensated E V/H signal.

(17) *LA-372A (12-inch lens cone) in R30° position.* When the LA-372A (12-inch lens cone) is installed and the MOUNT switch 3S2 on the photo control panel (Unit 3) is set to R30° position the operation is the same as mentioned for LA-372A in R30° position ((6) above), except for the system E V/H signal. System signal application is the same as mentioned for LA-372A in L30° position ((16)(*a*) and (*b*) above).

Figure 2-31. Printed circuit board and component assembly module 1A3, block diagram.
[Located in back of manual]

2-9. Rotary Mount Actuator (Unit 2) Circuits

a. Power and Distribution Circuit (fig. 2-32).

(1) *General.* The power and distribution circuit develops two dc operating voltages, four dc reference voltages, two drive voltages for a 800 pulse-per-second generator, and two ac voltages required by the driver and dc motor circuit. Required dc circuit voltages are obtained by utilizing a single power transformer T3, two full-wave rectifier circuits, two zener diode rectifier circuits, and a full-wave bridge rectifier circuit. The two ac voltages are obtained from two autowindings on the power transformer T3.

(2) *Power application and ac output voltages.* The mount 115-volt ac, 400-Hz, phase C power from the aircraft remote circuit breaker and ac-dc junction panel is applied through pin K of connector P1, filter FL1 to terminal 2 (primary winding) of power transformer T3. The mount interlock (ground) from the left access door interlock switch S4 is applied through pin M of connector P1, filter FL1 to terminal 4 (primary winding) of power transformer T3. With 115-volt ac, 400-Hz, phase C power applied, voltage is induced into two secondary windings and two primary autowindings of power transformer T3. The two primary autowindings output voltages are obtained between terminals 1 and 3 and 5 and 3 on power transformer T3. Each primary autowindings output (terminals 1 of 5) is 115 volts ac with reference to ac neutral (terminal 3) on power transformer T3 and are 180° out-of-phase with each other. The two 115-volt ac outputs (terminals 1 and 5) and ac neutral (terminal 3) on power transformer T3 are applied to the driver and dc motor circuit.

(3) *+12-volt dc and regulated +9-volt dc power supply.* The voltage induced in the secondary winding (terminals 6 and 10) on power transformer T3 is applied through terminals A1E1 and A1E5 on module A1 to a full-wave rectifier circuit consisting of diodes A1CR2 and A1CR7. The +12 volt dc output from the full-wave rectifier, filtered capacitors A1C1 and A1C13, is the operating voltage required by rotary mount actuator (Unit 2) circuits. The regulated +9-volt dc reference voltage is obtained by applying the +12-volt dc output voltage through limiting resistor A1R3 to a +9 volt Zener diode A1CR1. Zener diode A1CR1, functioning as a voltage regulator, establishes a 9-volt dc level which is used as a reference voltage in the mount position error signal output circuit, and the error and slew comparator amplifier circuit. The +12-volt dc and regulated +9-volt dc outputs are referenced to dc ground and chassis ground (terminal 8) on power transformer T3.

(4) *800 pulses-per-second generator drive voltage.* The drive voltage for the 800 pulses-per-second generator is obtained by applying two 400-Hz, 180° out-of-phase sine wave signals (terminals 6 and 10) on power transformer T3 to the input of two identical rectifier circuits using Zener diodes A1CR6 and A1CR5, respectively. The following discussion pertains to the rectifier circuit using Zener diode A1CR5 and associated circuitry.

(*a*) Assuming that the 400-Hz sine wave (terminal 10) on power transformer T3 is going positive, the signal present at the cathode of Zener diode A1CR5 will also be going positive. When the voltage at the cathode of Zener diode A1CR5 reaches +8.2 volts, the Zener diode con-

ducts applying a portion of the positive half-cycle through limiting resistor A1R6 to one of the 800 pulses-per-second generator drive inputs. The positive voltage reverse biases negative limiting diode A1CR8. Capacitor A1C11 shunts any interference to ground. When the voltage of the positive half-cycle, present at the cathode of zener diode A1CR5, decreases below the +8.2-volt level, zener diode A1CR5 is cut off. Therefore, the positive voltage is removed from the first 800 pulses-per-second drive input. As the negative half-cycle of the 400-Hz signal is applied to the cathode of Zener diode A1CR5, the Zener diode becomes forward biased and starts to conduct. The negative half-cycle is applied through limiting resistor A1R6 and forward biases negative limiting diode A1CR8. When forward biased, negative limiting diode A1CR8 shunts the negative half-cycle to dc ground. Therefore the output applied to the first drive input to the 800 pulses-per-second generator is positive pulses occurring at a 400-Hz rate.

(*b*) The rectifier circuit consisting of Zener diode A1CR6, limiting resistor A1R7, filter capacitor A1C12, and negative limiting diode A1CR9 operation is identical to that described in (*a*) above. Since the cathode of Zener diode A1-CR6 is connected to terminal 6 on power transformer T3, the 400 Hz sine wave input signal is 180° out-of-phase as compared to the input 400-Hz sine wave applied to the cathode of zener diode A1CR5. Therefore, the positive pulse output applied to the second 800 pulses-per-second generator drive input is delayed in time by 180° as compared to the first input positive drive pulse. Both input drive pulses are referenced to dc ground and chassis ground (terminal 8) on power transformer T3.

(5) *–6-volt dc and regulated –5.1-volt dc power supply.* The voltage induced in the secondary winding (terminals 7 and 9) on power transformer T3 is applied through terminals A1E2 and A1E4 on module A1 to a full-wave rectifier circuit consisting of diodes A1CR4 and A1CR3, respectively. The –6-volt dc output of the full-wave rectifier, filtered by capacitors A1-C2 and A1C14, is the –6-volt dc operating voltage required by rotary mount actuator (Unit 2) circuits. The regulated –5.1-volt dc reference voltage is obtained by applying the –6-volt dc output through limiting resistor A1R18 to –5.1-volt Zener diode A1CR25. Zener diode A1CR25, functioning as a voltage regulator, establishes a –5.1-volt dc level which is used as a reference voltage in the mount position error signal output circuit, and the error and slew comparator amplifier circuit. The –6-volt dc and regulated –5.1-volt dc outputs are referenced to dc ground and chassis ground (terminal 8) on the power transformer T3.

(6) *+100-volt dc and –100-volt dc power supply.* The voltage induced in the secondary winding (terminals 11 and 12) on power transformer T3 is applied to a full-wave bridge rectifier circuit consisting of diodes CR1 through CR4. The full-wave bridge rectifier circuit output is +10 volts dc and –100 volts dc after being applied to two series limiting resistors R1 and R2. Filtering action is provided by capacitor C1 which is connected between the –100-volt dc output of the full-wave bridge rectifier and the two limiting resistors. The +100-volt dc and –100-volt dc outputs are used as reference levels in the mount position error signal output circuit. The +100-volt dc and –100-volt dc output voltages are isolated from dc ground and chassis ground (terminal 8) of the power transformer T3.

Figure 2–32. Power and distribution circuit, block diagram.
[Located in back of manual]

b. Mount Position Error Signal Output Circuit (fig. 2–33).

(1) *General.* The mount position error signal output circuit establishes five dc output voltages which electrically represent the five-fixed camera mount positions of 15° left, 30° left, 90° (vertical), 30° right, and 15° right. The circuit consists of followup potentiometer R3, vertical adjust potentiometer R6, and associated circuitry.

(2) *Mount position voltage (error signal).* The –100-volt dc and +100-volt dc reference voltages from the power and distribution circuit are applied to terminals 1 and 3, respectively, on followup potentiometer R3. Therefore, the voltage drop across followup potentiometer R3 from terminal 1 to center terminal 6 is –100 volts dc and from terminal 3 to center terminal 6 is +100 volts dc. Two negative voltages, that electrically represent camera mount positions of 15° left (terminal 4) and 30° left (terminal 5), are obtained from followup potentiometer R3. These two negative voltages are applied to pins C and D, respectively of connector P1. Two positive voltages, that electrically represent camera mount positions of 15° right (terminal 8) and 30° right (terminal 7), are obtained from followup potentiometer R3. These two positive voltages are applied to pins B and E, respectively, of connector

P1. The 0 volt dc that electrically represents cam-era mount position of 90° (vertical) (terminal 6), is obtained from followup potentiometer R3. The 0 volt dc is applied to pin A of connector P1. The vertical adjust potentiometer R6 is provided to compensate for any unbalanced circuit condi-tion. The reference voltages of +9 volts dc and -5.1 volts dc from the power and distribution circuit, along with chassis ground, are used to obtain a 0-volt dc reference level adjustment. Any unbalanced circuit condition will be repre-sented by a voltage other than 0 volt dc (termi-nal 6) on followup potentiometer R3 when the camera mount is in the 90° position and MOUNT switch 3S2 on the photo control panel (Unit 3) is set to 90° position. When mechanical alignment of followup potentiometer R3 is cor-rect, the center tap (terminal 6) and the wiper (terminal 2) are electrically at the same position. The voltage caused by unbalanced circuit is pres-ent at the wiper (terminal 2) on the followup potentiometer R3. The wiper (terminal 2) on the vertical adjust potentiometer R6 and the wiper (terminal 2) on the followup potentiometer R3 are electrically connected together. By adjusting vertical adjust potentiometer R6 any voltage present at terminal 6 on followup potentiometer R3 may be nulled out.

(3) *Followup potentiometer operation.* Voltage present at the wiper of followup poten-tiometer R3 (terminal 2) electrically represents the actual camera mount position. The voltages at the five taps (terminals 4 through 8) on fol-lowup potentiometer R3, electrically represent five selectable camera mount positions. When a new camera mount position is selected by the MOUNT switch on the photo control panel (Unit 3), the voltage present at the appropriate terminal on followup potentiometer R3 is ap-plied through connector P1, by the external switching circuitry, to the input of the error and slew comparator amplifier circuit as the mount position (error) signal. The mount position volt-age (error signal) is a resultant of an algebraic summation of two voltages. The first voltage electrically represents the actual camera mount position present at the wiper (terminal 2) of fol-lowup potentiometer R3. The second voltage electrically represents the selected camera mount position present at the externally selected tap on followup potentiometer R3. As the dc motor re-positions the camera mount through the 430 to 1 gearbox, it also repositions the wiper (termi-nal 2) on followup potentiometer R3. When the actual camera mount position nears the newly selected camera mount position, the mount posi-tion voltage (error signal) nears a null. When the mount position voltage (error signal) is at a null, the wiper (terminal 2) on followup po-tentiometer R3 is electrically at the same posi-tion as the followup potentiometer R3 terminal previously selected by the external switching cir-cuitry. At this time, the dc motor stops. The mount position voltage (error signal) remains at a null until a new camera mount position is ex-ternally selected.

c. Error and Slew Comparator Amplifier Cir-cuit (fig. 2-34).

(1) *General.* When a difference in the actual camera mount position and the newly se-lected camera mount position is detected, the er-ror and slew comparator amplifier circuit deter-mines the direction and speed (slew rate) of dc motor rotation to reposition the camera mount. The error and slew comparator amplifier circuit consists of four identical comparator amplifiers (AR1 through AR4) on input voltage divider network, and associated circuitry. Comparator amplifiers AR1 and AR4 function as counter-clockwise and clockwise error comparator ampli-fiers respectively. Comparator amplifiers AR2 and AR3 function as counterclockwise and clock-wise slew comparator amplifiers, respectively.

(2) *Circuit input voltages.*

(*a*) The mount position (error) signal from the mount position error signal output cir-cuit is applied to pin H of connector P1. When the actual camera mount position is the same as the newly selected camera mount position, the in-put mount position (error) signal is at a null. The input mount position (error) signal goes positive when counterclockwise rotation of the dc motor is required to reposition the camera mount. Conversely, the input mount position (error) signal goes negative when clockwise ro-tation of the dc motor is required to reposition the camera mount.

(*b*) The +12-volt dc and -6-volt dc op-erating voltages, regulated +9-volt dc reference voltage, and regulated -5.1-volt dc reference voltage are the operating and reference voltages required for the error and slew comparator am-plifier circuit. All operating and reference volt-ages are obtained from the power and distribu-tion circuit (para 2-9*a*). The +12-volt dc and -6-volt dc operating voltages along with chassis ground are applied to terminals 8, 4 and 1, re-spectively, of the four comparator amplifiers AR1 through AR4. The regulated +9-volt dc ref-

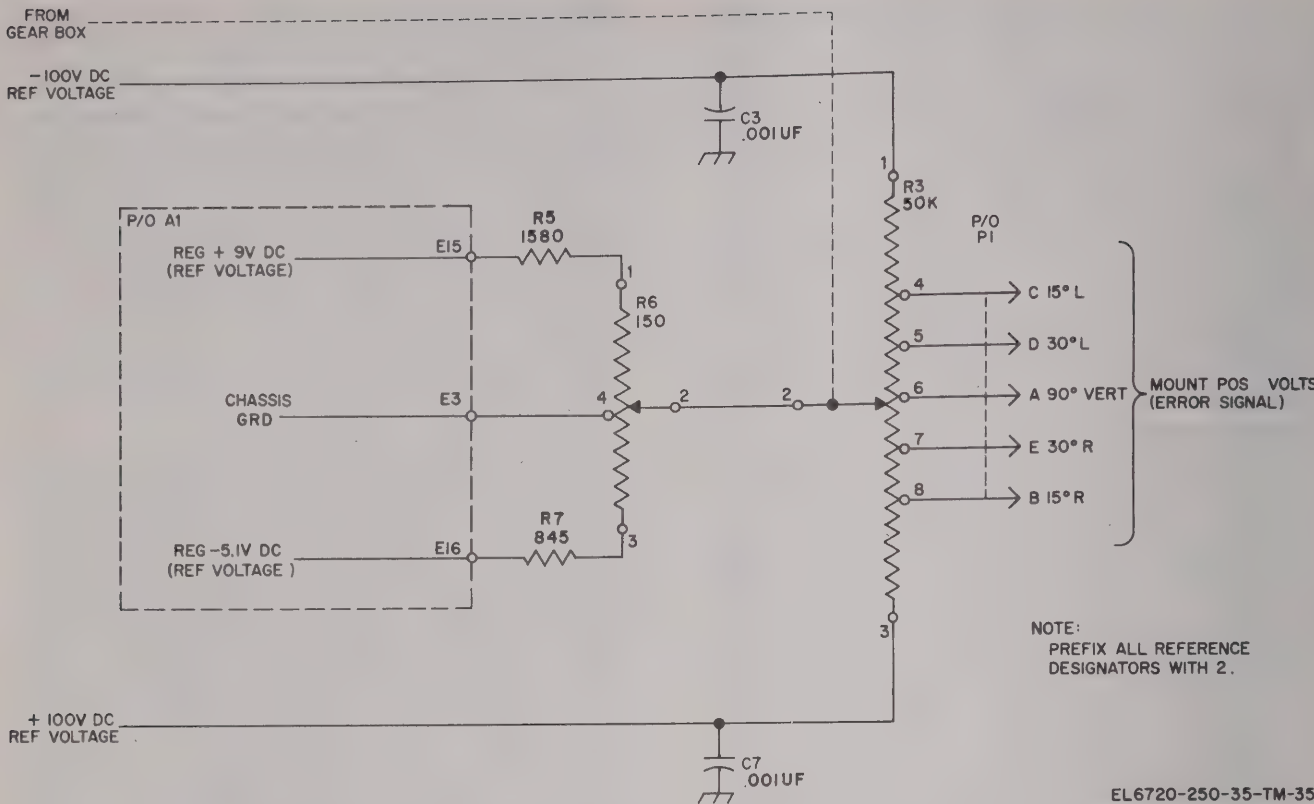


Figure 2–33. Mount position error signal output circuit, simplified schematic diagram.

erence voltage is applied through voltage divider resistors R4 and R5 to the inverting input (terminal 3) of the counterclockwise error comparator amplifier AR1. In addition, regulated +9-volt dc reference voltage is also applied through voltage divider resistors R8 and R9 to the inverting input (terminal 3) of the counterclockwise slew comparator AR2. A positive reference level is established at both inverting inputs (terminal 3) of comparator amplifiers AR1 AR2. The regulated –5.1-volt dc reference voltage is applied through voltage divider resistors R32 and R33 to the noninverting input (terminal 2) of clockwise slew comparator amplifier AR3. In addition, regulated –5.1-volt dc reference voltage is also applied through voltage divider resistors R40 and R47 to the noninverting input (terminal 2) of clockwise error comparator amplifier AR4. A negative reference level is established at both noninverting inputs (terminal 2) of comparator amplifiers AR3 and AR4.

(3) *Circuit operation.*

(*a*) When the input mount position (error) signal at pin H of connector P1 is other than null, the error signal is applied across an input voltage divider network consisting of a limiter circuit in parallel with two voltage divider circuits as follows: the limiter circuit consists of two 3.3-volt Zener diodes CR21 and CR24, connected cathode-to-cathode. The input mount position (error) signal at pin H of connector P1 is applied across Zener diodes CR21 and CR24 to chassis ground. If the input mount position (error) signal exceeds approximately +3.9 volt dc, Zener diode CR24 breaks down through forward biased Zener diode CR21. Conversely, if the input mount position (error) signal goes more negative than –3.9 volts dc, Zener diode CR21 breaks down, forward biasing Zener diode CR24. Therefore, the limiter circuit limits the input mount position (error) signal applied to the two input voltage dividers to an approximate maximum of 3.9 volts dc in either the positive or negative direction from null. When the mount position (error) signal is less than approximately +3.9 volts dc, and less negative than approximately –3.9 volts dc, the limiter circuit appears as an open circuit; the first input voltage divider network consist of potentiometer R25 and resistor R15. The total input mount position (error) signal at pin H of connector P1, between approximately +3.9 volts dc and –3.9 volts dc, is applied

across this voltage divider. Therefore, a portion of the input mount position (error) signal, present at the wiper on potentiometer R25, is applied to the noninverting input (terminal 2) of counterclockwise slew comparator amplifier AR2. In addition, a portion of the input mount position (error) signal is also applied to the inverting input (terminal 3) of clockwise slew comparator amplifier AR3. The adjustment of potentiometer R25 determines the input sensitivity of counterclockwise and clockwise slew comparator amplifiers AR2 and AR3, respectively; and the second input voltage divider network consists of resistor R48, potentiometer R42, and resistor R46. The total input mount position (error) signal at pin H of connector P1, between approximately +3.9 volt dc and -3.9 volts dc, is applied across this voltage divider. A portion of the input mount position (error) signal, present at the wiper of potentiometer R42, is applied to the noninverting input (terminal 2) of counterclockwise error comparator amplifier AR1. In addition, a portion of the input mount position (error) signal is also applied to the inverting input (terminal 3) of clockwise error comparator amplifier AR4. The adjustment of potentiometer R42 determines the input sensitivity of counterclockwise and clockwise error comparator amplifiers AR1 and AR4, respectively.

(*b*) When the input mount position (error) signal at pin H of connector P1 is at a null, comparator amplifiers AR1 through AR4 all have balanced inputs. The comparator amplifier outputs at terminal 7 will all be approximately -0.5 volt dc. If the mount position (error) signal goes positive, a portion of this voltage is applied by the two input voltage dividers to the noninverting input (terminal 2) of counterclockwise error and slew comparator amplifiers AR1 and AR2, respectively. The two voltage dividers also apply a portion of this positive voltage to the inverting input (terminal 3) of clockwise slew and error comparator amplifiers AR3 and AR4, respectively. Since the polarity of the input mount position (error) signal is positive and the reference level established at the inverting input (terminal 3) of counterclockwise error and slew comparator amplifiers AR1 and AR2, respectively, is positive, only these two comparator amplifiers will sense an unbalanced input. When the unbalanced input occurs, the outputs (terminal 7) of counterclockwise error and slew amplifiers AR1 and AR2, respectively change from an approximate -0.5 volt dc to an approximate +3.2 volts dc. The outputs (terminal 7) of the counterclockwise error and slew comparator amplifier AR1 and AR2 are the counterclockwise error and slew signals, respectively. These two signals applied through the mount ready and multivibrator disable circuit, and the counterclockwise gate and trigger circuit cause the dc motor to rotate counterclockwise at a maximum slew rate. If the input mount position (error) signal at pin H of connector P1 goes negative, clockwise slew and error comparator amplifiers AR3 and AR4, respectively, sense the unbalanced input. When the unbalanced input occurs, the outputs (terminal 7) of clockwise slew and error comparator amplifiers AR3 and AR4, change from an approximate -0.5 volt dc to an approximate +3.2 volts dc. The outputs (terminal 7) of the clockwise slew and error comparator amplifiers AR3 and AR4 are the clockwise slew and error signals, respectively. These two signals applied through the mount ready and multivibrator disable circuit, and the clockwise gate and trigger circuit cause the dc motor to rotate clockwise at a maximum slew rate.

(*c*) When the actual camera mount position nears the newly selected camera mount position, the input mount position (error) signal at pin H of connector P1 nears a null. Due to circuit characteristics and alignment, the appropriate slew comparator amplifier (AR2 or AR3) will sense a balanced input before the corresponding error comparator amplifier (AR1 or AR4). At this time, the output (terminal 7) of the affected slew comparator amplifier (AR2 or AR3) will change from an approximate +3.2 volt dc to an approximate -0.5 volt dc. This change in the appropriate slew signal is applied to the mount ready and multivibrator disable circuit and causes the dc motor slew rate to decrease. When the actual camera mount position is the same as the newly selected camera mount position, the input mount position (error) signal at pin H of connector P1 is at null. When this occurs, the appropriate error comparator amplifier (AR1 or AR4) will sense a balanced input. At this time, the output (terminal 7) of the affected error comparator amplifier (AR1 or AR4) will change from an approximate +3.2 volts dc to an approximate -0.5 volt dc. This change in output level is applied to the mount ready and multivibrator disable circuit, and the appropriate (clockwise or counterclockwise) gate and trigger circuit, causing the dc motor to stop rotating.

Figure 3-34. Error and slew comparator amplifier circuit, simplified schematic diagram.
[Located in back of manual]

d. 800 Pulses-per-second Generator and Multivibrator Circuit (fig. 2–35).

NOTE

Refer to figure 2–36 for typical pulse train waveforms mentioned in this discussion.

(1) *General.* The 800 pulses-per-second generator and multivibrator circuit furnishes two output pulse trains which are used to determine the slew rate of the dc motor in the driver and dc motor circuit. Both the 800 pulses-per-second generator (Q4 and Q5) and the multivibrator (Q10 and Q11) operate continuously as long as power is applied to the rotary mount actuator (Unit 2). However, the two output pulse trains are controlled by appropriate gating circuits.

(2) *800 pulses-per-second generator.* The 800 pulses-per-second generator consists of transistors Q4 and Q5 and buffer-inverter amplifier Q6. Two 400-Hz pulse train inputs (waveforms A and B) from the power and distribution circuit are applied as the two drive inputs to the 800 pulses-per-second generator. The two input pulse trains consist of positive-going pulses. However, the pulses in the second pulse train (waveform) are delayed in time by 180° as compared to the pulses in the first pulse train (waveform A). Therefore, the 800 pulses-per-second generator is driven at an 800 Hz rate. This results in a negative-going 800-Hz pulse train output (waveform C) which is applied as the input to buffer-inverter amplifier Q6. The output of the buffer-inverter amplifier Q6 is an 800 Hz positive-going pulse train (waveform D). The positive-going pulse train (waveform D) is applied as one input to a NOR gate consisting of diodes CR13, CR14 and CR15, and transistor Q2; this NOR gate is located in the counterclockwise gate and trigger circuit. In addition, the positive-going pulse train (waveform D) is also applied as one input to a NOR gate consisting of diodes CR17, CR18 and CR20, and transistor Q12; this NOR gate is located in the clockwise gate and trigger circuit.

(3) *Multivibrator.* The free-running multivibrator consists of transistors Q10 and Q11, and associated circuitry. Due to an unbalance in the multivibrator stages, the output (waveform E) is nonsymmetrical. This nonsymmetrical pulse train output (waveform E) is applied as one input to a NOR gate consisting of resistor R34, diodes CR10 and CR16, and transistor Q9, which is located in the mount ready and multivibrator disable circuit.

NOTE

Refer to figure 2–36 for typical pulse train waveforms mentioned in this discussion.

e. Mount Ready and Multivibrator Disable Circuit (fig. 2–35).

(1) *General.* The mount ready and multivibrator disable circuit applies a mount ready ground to pin N on connector P1 when the actual camera mount position is the same as the selected camera mount position. This circuit also controls application of the nonsymmetrical pulse train from the multivibrator, in the 800 pulses-per-second generator and multivibrator circuit, to the clockwise and counterclockwise gate and trigger circuits. The mount ready and multivibrator disable circuit consists of the mount ready NOR gate consisting of diodes CR11 and CR19, and transistor Q7; the inverter-driver amplifier consisting of transistor Q8; and the multivibrator disable NOR gate consisting of resistor R34, diodes CR10 and CR16, and transistor Q9.

(2) *Mount ready circuitry.* The clockwise and counterclockwise error signals from the error and slew compárator amplifier circuit are applied as the inputs to the mount ready NOR gate (Q7). When the actual camera mount position is the same as the selected camera mount position, both the clockwise and counterclockwise error signals are approximately –0.5 volt (low). With both inputs to the mount ready NOR gate (Q7) low, the NOR gate (Q7) output will be +12 volts dc (high). This high output is applied to the input of inverter-driver amplifier transistor Q8 resulting in a ground (low) output. The ground (low) output of inverter-driver Q8 is applied to pin N on connector P1 as the mount ready ground. When the actual camera mount position is not the same as the newly selected camera mount position, the appropriate error signal (counterclockwise or clockwise) input to the mount ready NOR gate (Q7) will be approximately +3.2 volts dc (high). With eigher input to the mount ready NOR gate (Q7) high, the NOR gate (Q7) output will be approximately +0.6 volt dc (low). This low NOR gate (Q7) output is applied to the input of inverter-driver amplifier Q8 and results in an open circuit (high) output. Therefore, the mount ready ground at pin N on connector P1 is open when the actual camera mount position is not the same as the newly selected mount position.

(3) *Multivibrator disable NOR gate.* The input signals to the multivibrator disable NOR

gate consisting of resistor R34, diodes CR10 and CR16, and transistor Q9 are the nonsymmetrical pulse train from the multivibrator (Q10 and Q11); and the clockwise and counterclockwise slew signals from the error and slew comparator amplifier circuit.

(*a*) When the actual camera mount position is the same as the selected camera mount position, the counterclockwise and clockwise slew signals from the error and slew comparator amplifier circuit are approximately –0.5-volt dc (low). These two low signals along with the nonsymmetrical pulse train output (waveform E) from the multivibrator (Q10 and Q11) results in a multivibrator disable NOR gate (Q9) output of an inverted nonsymmetrical pulse train (waveform F). The output (waveform F) of the NOR gate (Q9) is applied as one input to a NOR gate consisting of diodes CR13, CR14 and CR15, and transistor Q2. This NOR gate (Q2) is located in the counterclockwise gate and trigger circuit. In addition, the output (waveform F) is also applied as one input to a NOR gate consisting of diodes CR17, CR18 and CR20, and transistor Q12. This NOR gate (Q12) is located in the clockwise gate and trigger circuit.

(*b*) When the actual camera mount position is not the same as the newly selected camera mount position, either the clockwise or counterclockwise slew signal from the error and comparator amplifier circuit will change from an approximate –0.5 volt dc (low) to an approximate +3.2 volts dc (high). This high is applied as one input to the multivibrator disable NOR gate (Q9) and results in a NOR gate (Q9) output of approximately +0.6 volt dc (low). Therefore, the multivibrator output (waveform E) which is also one input to the multivibrator disable NOR gate (Q9) is effectively disabled. The low output of the multivibrator disable NOR gate (Q9) is applied to the NOR gates (Q2 and Q12) in the counterclockwise and clockwise gate and trigger circuits instead of the nonsymmetrical pulse train (waveform F), as discussed in (*a*) above.

(*c*) As the actual camera mount position nears the newly selected camera mount position, the appropriate slew signal (counterclockwise or clockwise) from the error and slew amplifier circuit changes from an approximate +3.2 volts dc (high) to an approximate –0.5 volt dc (low). With both the counterclockwise clockwise slew signals low, the multivibrator (Q10 and Q11), nonsymmetrical output pulse train (waveform E) is enabled by the multivibrator disable NOR gate (Q9). Therefore, the output of the multivibrator disable NOR gate (Q9) (waveform F) is as previously discussed in (*a*) above.

f. Clockwise and Counterclockwise Gate and Trigger Circuits (fig. 2–35).

NOTE

Refer to figure 2–36 for typical pulse train waveforms mentions in this discussion.

(1) *General.* The clockwise and counterclockwise gate and trigger circuits are two identical circuits which, when activated, apply trigger pulses to the driver circuitry in the driver and dc motor circuit. The clockwise gate and trigger circuit consists of an inverter amplifier transistor Q14, a NOR gate consisting of diodes CR17, CR18, and CR20, and transistor Q12, a unijunction transistor Q13; the primary of transformer T1, and associated circuitry. The counterclockwise gate and trigger circuit consists of an inverter and amplifier transistor Q1; a NOR gate consisting of diodes CR13, CR14 and CR15, and transistor Q2, a unijunction transistor Q3; the primary of transformer T2, and associated circuitry. Since the clockwise and counterclockwise gate and trigger circuits are identical, only the operation of the clockwise gate and trigger circuit is discussed in (2) below.

(2) *Clockwise gate and trigger circuit operation.*

(*a*) When the actual camera mount position is the same as the selected camera mount position, the clockwise error signal from the error and slew comparator amplifier circuit is approximately –0.5-volt dc (low). This low input is applied to inverter amplifier transistor Q14 and results in a +12-volt dc (high) output. This high output is one of three inputs to the NOR gate (Q12). The second input to the NOR gate (Q12) is an 800 pulse-per-second pulse train (waveform D) from the 800 pulse-per-second generator. The third input to the NOR gate (Q12) is a nonsymmetrical pulse train (waveform F) from the NOR gate (Q9) in the mount ready and multivibrator disable circuit. Since the high output from inverter amplifier Q14 to the first NOR gate (Q12) input functions as a disabling voltage, the NOR gate (Q12) output will be approximately +0.6-volt dc (low). This low output from NOR gate (Q12) is applied through resistor R39 to the emitter of unijunction transistor Q13 and to one side of capacitor C10. Capacitor C10, connected between –6 volts dc from the

power and distribution circuit and the emitter of unijunction transistor Q13 is charged to an approximate level of 6.6 volts dc. This voltage level is not sufficient to trigger unijunction transistor Q13.

(*b*) When the actual camera mount position is not the same as the newly selected camera mount position and assuming clockwise rotation of the dc motor is required to reposition the camera mount, the clockwise error signal from the error and slew comparator amplifier circuit is approximately +3.2 volts dc (high). This high input is applied to inverter amplifier transistor Q14 and results in an approximately +0.6-volt dc (low) output. This low output is one of the three inputs to the NOR gate (Q12) and is used to enable the gate. The second input to the NOR gate (Q12) is the 800 pulse-per-second pulse train (waveform D) as previously discussed in (*a*) above. The third input to the NOR gate (Q12) is a low from a NOR gate (Q9) in the mount ready and multivibrator disable circuit. Since two inputs to the NOR gate (Q12) are low, the NOR gate (Q12) output (waveform G) will be a function of the 800 pulse-per-second pulse train input. The 800 pulse-per-second pulse train output of the NOR gate (Q12) (waveform G) is applied through resistor R39 to the emitter of unijunction transistor Q13 and to one side of capacitor C10. When the pulse train at the emitter of unijunction transistor Q13 is going positive (waveform G), capacitor C10 starts to charge to 18 volts dc from the –6 volt dc on one side to the +12 volts, through resistor R39 and R26, on the other side. At some instant before the potential across capacitor C10 reaches 18 volts, unijunction transistor Q13 is triggered. When unijunction transistor Q13 is triggered, capacitor C10 discharges through the primary winding of transformer T1, from terminal 1 to terminal 2, and through base B1 to the emitter of unijunction transistor Q13. The discharging of capacitor C10 produces a large negative-going spike in the primary of transformer T1. When the 800 pulse-per-second pulse train (waveform D) applied to the input of the NOR gate (Q12) goes positive, unijunction transistor Q13 is cut off. During this period, capacitor C10 recharges to approximately 6.6 volts dc. Therefore, when the next positive-going pulse occurs at the emitter of unijunction transistor Q13, the above cycle will repeat itself.

(*c*) When the actual camera mount position nears the newly selected camera mount position, the input to the NOR gate (Q12) from the NOR gate (Q9) in the mount ready and multivibrator disable circuit changes from a low to a nonsymmetrical pulse train (waveform F). Therefore, the three inputs to the NOR gate (Q12) are a low, an 800 pulse-per-second pulse train (waveform D) and a nonsymmetrical pulse train (waveform F). Since the low input to the NOR gate (Q12) is an enabling voltage, the NOR gate output (Q12) (waveform H) will be a function of the two pulse train inputs (waveforms D and F). The nonsymmetrical pulse train input (waveform F) disables the NOR gate (Q12) for 220 milliseconds and enables the NOR gate (Q12) for 80 milliseconds. During the time the NOR gate (Q12) is disabled (220 milliseconds) the NOR gate (Q12) output (waveform H) will be approximately +0.6 volt dc (low). Therefore, unijunction transistor Q13 can not be triggered during this time. During the time the NOR gate (Q12) is enables (80 milliseconds), the NOR gate (Q12) output (waveform H) will be a function of the 800 pulse-per-second pulse train. At this time unijunction transistor Q13 is triggered as discussed in (*b*) above. As the actual camera mount position nears the newly selected camera mount position, unijunction transistor Q13 is triggered for 80 milliseconds out of approximately every 300 milliseconds.

(*d*) When the actual camera mount position is the same as the newly selected camera mount position, the clockwise error signal from the error and slew comparator amplifier circuit disables the NOR gate (Q12). The clockwise gate and trigger circuit conditions are as discussed in (*a*) above.

(3) *Counterclockwise gate and trigger circuit operation.* The counterclockwise gate and trigger circuit functions in the same manner as discussed for clockwise gate and trigger circuit ((2) above), except that the NOR gate (Q2) is enabled or disabled by the counterclockwise error signal from the error and slew comparator amplifier circuit.

g. Driver and Dc Motor Circuit (fig. 2–35).

(1) *General.* The driver and dc motor circuit utilizes trigger input pulses from either the clockwise or counterclockwise gate and trigger circuits to develop and apply dc drive voltages of correct polarity to dc motor B1. Through a 430 to 1 gearbox, dc motor B1 repositions the camera mount to the newly selected position. The dc motor through the 430 to 1 gearbox also repositions followup potentiometer R3 in the mount position error signal output circuit and operates a cam in limit switch S1. The driver and

c motor circuit consists of secondary windings n transformers T1 and T2, four silicon-controlled rectifiers CR7 through CR10, limit witch S1, dc motor and brake B1, 430 to 1 gear-ox, and associated circuitry.

(2) *Driver and dc motor circuit operation.*

(*a*) *Dc motor B1 stopped.*

NOTE

The following circuit description assumes that the actual camera mount position is the same as the selected camera mount position.

here are no trigger pulses developed across ther the primary of transformer T1, part of the ockwise gate and trigger circuit, or the priary of transformer T2, part of the counter-ockwise gate and trigger circuit. There are no duced voltages in the secondary windings of ther transformer T1 or transformer T2. Silicon-ntrolled rectifiers CR7 through CR10 remain ated off and, no dc motor drive voltages are eveloped.

(*b*) *Clockwise dc motor B1 rotation.*

NOTE

The following circuit description assumes that the actual camera mount position is not the same as the newly selected camera mount position and clockwise rotation of dc motor B1 is required to reposition the camera mount.

egative-going pulses (*f*(2)(*b*) above) at an 0-Hz rate are developed across the primary of ansformer T1. When terminal 1 on transformer l is negative with respect to terminal 2, the ltage spike induced in the secondary windings sults in terminal 3 being negative with respect terminal 4, and terminal 5 being negative with spect to terminal 6. At the same time if it is sumed that terminal 1 on power transformer 3 is positive with respect to terminal 5, silicon-ntrolled rectifier CR7 will be gated on by the sitive voltage at terminal 6 on transformer T1. ie negative voltage present at terminal 5 on wer transformer T3 is applied through silicon-ntrolled rectifier CR7 (cathode to anode), the rmally closed A section (clockwise) contacts of nit switch S1 to the red terminal on dc motor . When the voltage present at terminal 1 on wer transformer T3 is negative with respect to e voltage present at terminal 5, silicon-conlled rectifier CR8 is gated on by the positive ltage at terminal 4 on power transformer T1. The negative voltage present at terminal 1 on power transformer T3 is applied through silicon-controlled rectifier CR8 (cathode to anode), normally-closed A section (clockwise) contacts of limit switch S1 to the red terminal on dc motor B1. At the time silicon-controlled rectifier CR7 is gated on, the positive voltage present at terminal 1 on power transformer T3 is applied to the cathode of silicon-controlled rectifier CR8. This positive voltage acts as reverse bias, thereby preventing silicon-controlled rectifier CR8 from being gated on. Conversely, when silicon-controlled rectifier CR8 is gated on, the positive voltage present at terminal 5 on power transformer T3 is applied to the cathode of silicon-controlled rectifier CR7. This positive voltage acts as reverse bias, thereby preventing silicon-controlled rectifier CR7 from being gated on. Since at this time the voltage spikes that gate on silicon-controlled rectifiers CR7 and CR8 are being induced in the secondary windings of transformer T1 at an 800-Hz rate, full wave rectification of the 115 volts ac 400 Hz, present at terminals 1 and 5 on power transformer T3 is obtained. This full wave rectification results in a negative dc voltage being applied to the red terminal on the dc motor B1. The black terminal on dc motor B1 is connected to ac neutral (terminal 3) on power transformer T3. A negative drive voltage is applied to dc motor B1 causing the motor to rotate clockwise.

NOTE

The following circuit description assumes that the actual camera mount position is not the same as the newly selected camera mount position and counterclockwise rotation of the dc motor is required to reposition the camera mount.

(*c*) *Counterclockwise dc motor rotation.* Negative-going pulses (*f*(3) above) at an 800-Hz rate are developed across the primary of transformer T2. When terminal 1 on transformer T2 is negative with respect to terminal 2, the voltage spike induced in the secondary windings results in terminal 3 being negative with respect to terminal 4, and terminal 5 being negative with respect to terminal 6. At the same time it is assumed that terminal 1 on power transformer T3 is positive with respect to terminal 5, silicon-controlled rectifier CR9 will be gated on by the positive voltage at terminal 4 on transformer T2. The positive voltage present at terminal 1 on power transformer T3 is applied through silicon-

controlled rectifier CR9 (anode to cathode), the normally-closed B section (counterclockwise) contacts of limit switch S1 to the red terminal on dc motor B1. When the voltage present at terminal 1 on power transformer T3 is negative in respect to the voltage present at terminal 5, silicon-controlled rectifier CR10 is gated on by the positive voltage present at terminal 6 on transformer T2. The positive voltage at terminal 5 on power transformer T3 is applied through silicon-controlled rectifier CR10 (anode to cathode), normally closed B section (counterclockwise) contacts of limit switch S1 to the red terminal on dc motor B1. At the time silicon-controlled rectifier CR9 is gated on, the negative voltage present at terminal 5 on power transformer T3 is applied to the anode of silicon-controlled rectifier CR10. This negative voltage acts as reverse bias, thereby preventing silicon-controlled rectifier CR10 from being gated on. Conversely, when silicon-controlled rectifier CR10 is gated on, the negative voltage present at terminal 1 on power transformer T3 is applied to the anode of silicon-controlled rectifier CR9. This negative voltage acts as reverse bias, thereby preventing silicon-controlled rectifier CR9 from being gated on. As discussed in (*b*) above, the 115 volts ac, 400 Hz, present at terminals 1 and 5 on power transformer T3 is full-wave rectified and results in a positive drive voltage applied to the red terminal on dc motor B1. This positive drive voltage results in counterclockwise dc motor B1 rotation.

(*d*) *Decreased dc motor slew rate.* As the actual camera mount position nears the newly selected camera mount position, the dc motor B1 slew rate (speed) decreases. This is accomplished by only applying trigger pulses (800 pulses-per-second) to the appropriate transformer (T1 or T2) 80 milliseconds out of every 300 milliseconds. Therefore, the activated silicon-controlled rectifier circuit, either CR7 and CR8 or CR9 and CR10, will supply drive voltage to the dc motor B1 80 milliseconds out of every 300 milliseconds. This results in the dc motor B1 seeing a lower average dc drive voltage and therefore causes a slower rotation of the dc motor.

(3) *Dc motor brake.* The dc motor brake is an electromechanical device that stops the rotation of dc motor B1 within 10 revolutions after the drive voltage is removed. The brake is not released until the drive voltage, present at the red terminal on dc motor B1, is 96 volts dc. This dc motor B1 holding action insures that the motor drive voltage is sufficient to overcome the initial mechanical inertia.

(4) *Limit switch S1.* Limit switch S1 prevents damage to motor driven parts, such as the followup potentiometer R3 in the mount position error signal output circuit, caused by overdriving. If an electrical malfunction or electrical circuit misalignment occurs, the dc motor B1 could continue to rotate in either the clockwise or counterclockwise direction beyond the normal mechanical limits of the motor driven parts. However, before mechanical damage is caused, a cam-operated limit switch S1 will open the dc motor B1 drive voltage circuit causing the dc motor to stop. The cam in limit switch S1 is mechanically operated by dc motor B1 through the 430 to 1 gearbox.

Figure 2-35. Dc motor control and positioning and mount ready circuits, simplified schematic diagram.
[Located in back of manual]

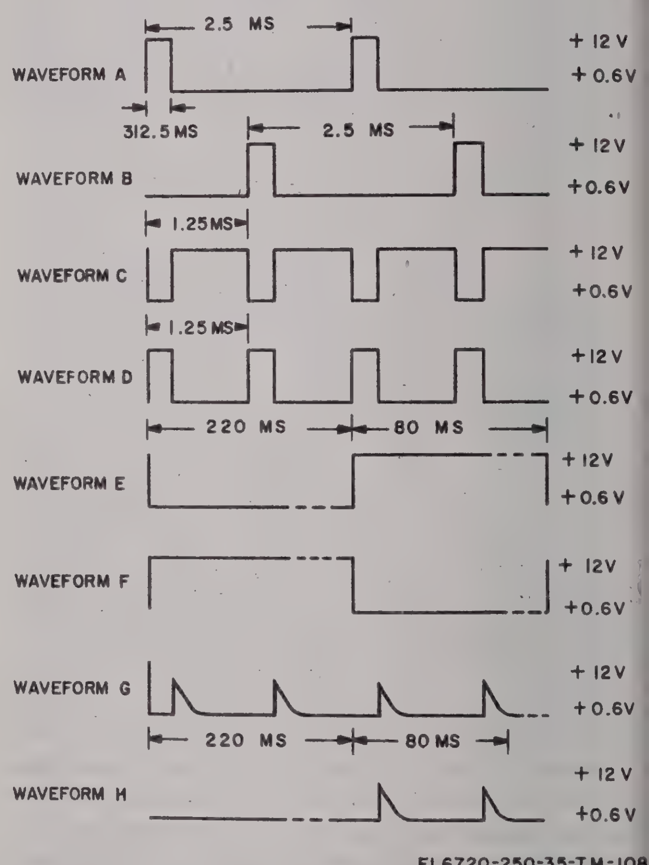


Figure 2-36. Dc motor control and positioning and mount ready circuits, waveforms.

Figure 2-37(1). Camera control system, wiring diagram (aircraft No. 68-16990-01 and subsequent) (part 1 of 2).
[Located in back of manual]

Figure 2-37(2). Camera control system, wiring diagram (aircraft No. 68-16990-01 and subsequent) (part 2 of 2).
[Located in back of manual]

Figure 2-38(1). Camera control system, wiring diagram (aircraft No's. 67-18998N, 67-18899N, 67-18902N and 67-18905N) (part 1 of 2).
[Located in back of manual]

Figure 2-38(2). Camera control system, wiring diagram (aircraft No's. 67-18998N, 67-18899N, 67-18902N and 67-18905N) (part 2 of 2).
[Located in back of manual]

CHAPTER 3

DIRECT SUPPORT MAINTENANCE

Section I. GENERAL

–1. Scope of Direct Support Maintenance

a. The maintenance duties assigned to the di-
ect support maintenance repairman of camera
ontrol system major components are listed be-
w together with references to the paragraphs
overing specific maintenance functions. Pri-
arily, the duties are limited to—

(1) *Manual V/H control panel (Unit 7).* erform an operational checkout (para 3–5*a*), oubleshooting procedures (para 3–5*b*), voltage nd resistance measurements (para 3–5*c*), disas- mbly procedures (para 3–12*a*), and reassembly rocedures (para 3–12*b*).

(2) *Photo junction panel (Unit 8).* Per- rm an operational checkout (para 3–6*a*), trou- eshooting procedures (para 3–6*b*), resistance easurements (para 3–6*c*), disassembly proce- ures (para 3–13*a*), and reassembly procedures ara 3–13*b*).

(3) *Photo control panel (Unit 3).* Perform operation checkout (para 3–7*a*), troubleshoot- g procedures (para 3–7*b*), voltage and resist- ce measurements (para 3–7*c*), disassembly rocedures (para 3–14*a*), and reassembly proce- ures (para 3–14*b*).

(4) *Photo system assembly (Unit 1).* Per- rm an operational checkout (para 3–8*a*), trou- eshooting procedures (para 3–8*b*), voltage and sistance measurements (para 3–8*c*), disassem- y procedures (para 3–15*a*), and reassembly rocedures (para 3–15*b*).

(5) *Camera pulse panel (134AV81400–1 or 4AV81400–3) (Unit 6).* Perform an opera- onal checkout (para 3–9*a*), troubleshooting ocedure (para 3–9*b*), resistance measurements ara 3–9*c*), disassembly procedures (para 3– *a*), and reassembly procedures (para 3–16*b*).

(6) *Pod assembly (Unit 10).* Direct sup- rt maintenance instructions for the pod assem- (Unit 10) are given in TM 11–6760–228–35–

(7) *Camera (Unit 9).* Direct support maintenance instructions for the camera (Unit 9) are given in TM 11–6720–236–35.

b. Direct support maintenance is not performed on the major components listed below.

NOTE

Refer to higher category maintenance for these major components.

(1) Rotary mount actuator (Unit 2).

(2) Left, right, and vertical door actuators (Unit 4).

(3) Left, right, and vertical light sensors (Unit 5).

(4) Camera mount A (Unit 11) or camera mount B (Unit 12).

(5) Flight line tracker (Unit 13).

(6) Right oblique sight (Unit 14) and left oblique sight (Unit 15).

3–2. Tools, Test Equipment, and Material Required

a. Tools.

(1) Tool Kit, TK–77/GF.

(2) Tool Kit, TK–109/GF.

b. Test Equipment.

(1) Multimeter TS–352B/U.

(2) Power source, 108 to 118 volts ac, single phase, 400 Hz.

(3) Power source, 109 to 116.5 volts ac, three phase, 400 Hz.

(4) Power source, +24 to +28.5 volts dc.

c. Materials.

(1) Connector, MS3106E–22–21S.

(2) Connector, MS3106–22–55P.

(3) Connector, MS3126F–14–19S.

(4) Connector, MS3126F–18–32S.

(5) Electrical clip, Type TCI per Federal Specification W–C–440.

(6) Lamp, MS25231–313 (7 required).

(7) Lamp socket, MS90287–8 (2 required).

(8) Resistor, RW24V100 (2 required).
(9) Switch, MS24655-221 (9 required).
(10) Switch, MS25089-1A (MIL-S-8805/3) (3 required).
(11) Switch, MS25103-24 (3 required).
(12) Switch, MS35058-22 (4 required).
(13) Terminal board, MIL-T-55164/14, type 8TB6.
(14) Terminal board, MS27212-1-11.
(15) Terminal board, MS27212-1-20.
(16) Terminal board, MS27212-1-23.
(17) Zener diode, 1N1600 (2 required).
(18) Wiring, No. 16 AWG (as required).
(19) Wiring, No. 18 AWG (as required)
(20) Wiring, No. 22 AWG (as required).
(21) Cleaning compound (Federal stock No 7930-395-9542).
(22) Battery, 6 volt (Federal stock No 6135-643-1310).

Section II. DIRECT SUPPORT TROUBLESHOOTING

WARNING

Dangerous voltages exist in the pod assembly high voltage circuits after power has been removed. Use a ground rod with a series 5-kilohm, 10-watt resistor, and discharge all high voltage circuits before touching any of the components. The grounding is accomplished between the xenon flashlamp metal connecting arms and the illuminator module chassis.

WARNING

Be careful when working on the 115-volt ac, 400-Hz, line connections and the 28-volt dc connections. Serious injury or death may result from contact with these terminals.

3-3. General

a. Troubleshooting at direct support maintenance includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. The direct support maintenance procedures are not complete in themselves but supplement the procedures outlined in TM 11-6720-250-12. This chapter provides troubleshooting procedures which must be performed by the direct support maintenance repairman.

b. Troubleshooting may be performed after the major components (or parts of them) have been removed from service. When trouble occurs certain observations and measurements can be made that will help to determine the source of trouble. Usually, when troubleshooting (sectionalization) is performed while the camera control system is operating, it is done at the organizational level (TM 11-6720-250-12). Paragraph 3-4 describes the systematic procedure to be followed which will enable the direct support maintenance personnel to isolate the cause of the trouble and correct the fault.

3-4. Organization of General Troubleshooting Procedures

a. General. Three steps are used in troubleshooting any type of equipment. They are: *sectionalization, localization* and *isolation.* Section alization means tracing the fault to the majo component. Localization means tracing the faul to the defective section or stage within a majo component. Isolation means tracing the fault t the defective part. Some faults can often be iso lated by sight, touch, or hearing. The majorit of faults, however, must be isolated by detaile electrical, mechanical, and electronic checks.

b. Sectionalization Checks. Sectionalization o troubles is started with a troubleshooting char provided in TM 11-6720-250-12.

c. Localization Checks. After the trouble ha been sectionalized to a major component, make general operational check (*a* of paras 3- through 3-9). The operational check serves as check of the localization technique. In additio assemblies or subassemblies in some instance parts can be localized within the major comp nents by the methods listed (1) through (3) b low.

(1) *Visual Inspection.* The purpose of vi ual inspection is to locate faults without testi or measuring circuits or components. All visu signals should be analyzed to help locate t fault to a particular subchassis, stage, or pa Mechanical faults are most often locali through visual inspection.

(2) *Troubleshooting charts.* The troub symptoms listed in the troubleshooting charts

paras 3-5 through 3-9) will aid in localizing ouble in a major component to a defective part, bassembly, or assembly.

(3) *Signal substitution.* Signal substitution ocedures quickly enable localization of a trou- e. An oscilloscope, RC bridge, or differential ltmeter may be used in signal substitution pro- dures.

d. Isolation Checks. Isolation checks for indi- dual assemblies and subassemblies will be per- rmed at the direct support maintenance level. efective parts can be isolated by the methods ted in (1) through (2) below.

(1) *Voltage and resistance measurements.* serve all cautions given to prevent transistor mage. Make voltage and resistance measure- ents in this equipment only as specified. When easuring voltages, use tape or sleeving to in- late the entire test prod except for the extreme . A momentary short circuit can ruin the tran- tor. (*For example,* if the base to collector is orted out, excessive current would ruin the ansistor). Use voltage and resistance charts (*c* paras 3-5 through 3-9) to find normal read- gs, and compare them with readings taken. All voltages measured with the multimeter should taken from the approximate range jack on the 000 OHMS PER VOLT DC jacks column. All voltage should be taken from the 1000 OHMS R VOLT AC DC jacks column.

(2) *Intermittent troubles.* In all tests, the ssibility of intermittent troubles should not be erlooked. If present, this type of trouble may en be made evident by tapping or jarring the uipment. Check the wiring and connections to assemblies and subassemblies of the major mponent under test.

CAUTION

The equipment is transistorized. To prevent possible damage or destruction of transistors by excessive current, use only the RX100 range on the multimeter to make circuit resistance measurements.

NOTE

When measuring positive voltages, connect the negative lead of multimeter to chassis ground. When measuring negative voltages, connect the positive lead of the multimeter to chassis ground.

3-5. Manual V/H Control Panel (Unit 7) Troubleshooting

Direct support troubleshooting procedures for the manual V/H control panel are given below.

a. Operational Check.

WARNING

Make sure that 115-volt ac, 400-Hz, and +28-volt dc power sources are off before performing steps (1) through (4) below. Dangerous voltages of 115 volts ac, 400 Hz and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate a test cable as shown in figure 3-1.

(2) Set switches on manual V/H control panel as follows:

(*a*) POWER switch 7S1 to OFF position.

(*b*) OVERRIDE switch 7S2 to MANUAL position.

(*c*) VELOCITY-KNOTS thumbwheels to 200.

(*d*) ALTITUDE-FEET thumbwheels to 00100.

(3) Set switches S1, S2, S3, and S4 on test cable to their off (open) positions.

(4) Connect test cable to ac and dc power sources as shown in figure 3-1. Connect connector P1 on test cable to connector 7J1 on manual V/H control panel.

(5) Turn on ac and dc power sources. Set switch S1 on test cable to on (closed) position. Allow 15 minutes for warmup.

(6) Observe the manual V/H control panel. The front panel edge lamps, VELOCITY-KNOTS thumbwheel lamps, and ALTITUDE-FEET thumbwheel lamps should light.

(7) Set POWER switch 7S1 on manual V/H control panel to ON. The AUTO FAIL indicator should flash at approximate rate of one flash-per-second.

(8) Momentarily depress PRESS TO RESET switch 7S3 on manual V/H control panel. The AUTO FAIL indicator should stop flashing and remain lit constantly.

(9) Set switch S4 on test cable to on (closed) position. The AUTO FAIL indicator on manual V/H control panel should go out.

(10) Set switch S2 on test cable to on (closed) position. The AUTO FAIL indicator on manual V/H control panel should flash at approximate rate of one flash-per-second.

(11) Momentarily depress PRESS TO RESET switch 7S3 on manual V/H control panel.

The AUTO FAIL indicator should stop flashing and remain lit constantly.

(12) Set switch S3 on test cable to on (closed) position. The AUTO FAIL indicator on manual V/H control panel should remain lit but dimly.

(13) Set switches S2 and S3 on test cable to off (open) position. The AUTO FAIL indicator on manual V/H control panel should go out.

(14) Depress and hold AUTO FAIL TEST pushbutton switch 7S4 on mnaual V/H control panel. The AUTO FAIL indicator should flash at approximate rate of one flash-per-second.

(15) Release AUTO FAIL TEST pushbutton switch 7S4. The AUTO FAIL indicator should go out.

NOTE

In the following steps, use the multimeter to make circuit voltage measurements.

(16) Using multimeter on the +50-volt dc range, measure voltage between terminals (P) (–) and M (+) on terminal board TB1 on test cable. Multimeter should indicate 0 volt dc. Leave multimeter connected to terminals TB1–P and TB1–M.

(17) Set OVERRIDE switch 7S2 on manual V/H control panel to AUTO position. Multimeter should indicate from +26.5 to +29.5 volts dc.

(18) Set OVERRIDE switch 7S2 on manual V/H control panel to MANUAL position and disconnect multimeter from terminal board TB1.

(19) Using multimeter on the +250-volt dc range, measure voltage between terminals TB1–D(–) and TB1–E(+). Multimeter should indicate from +98 to +102 volts dc. Leave multimeter connected to terminals TB1–D and TB1–E.

(20) On manual V/H control panel, set VELOCITY-KNOTS thumbwheels to 050 and ALTITUDE-FEET thumbwheels to 00050.

(21) Using multimeter on the +250-volt dc range, multimeter should indicate from +48 to +52 volts dc.

(22) On manual V/H control panel, set VELOCITY-KNOTS thumbwheels to 450 and ALTITUDE-FEET thumbwheels to 49990.

(23) Using multimeter on the +2.5-volt dc range, multimeter should indicate from +0.4 to +0.6 volt dc.

(24) Set POWER switch 7S1 on manual V/H control panel to OFF position. Set all switches on test cable to their off (open) positions.

(25) Turn off ac and dc power sources, and disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operation check (*a* above). Electronic parts referenced in the troubleshooting chart and associated circuits are shown in the schematic diagram (fig. 3–2) and wiring diagram (fig. 3–3).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Front panel edge lamps VELOCITY-KNOTS thumbwheel lamps, and ALTITUDE-FEET thumbwheel lamps all remain out (step 6).	Defective wiring	Corrective measures are not within the capabilities of direct support maintenance repairman. Refer to higher category of maintenance.
2	Individual lamps in either VELOCITY-KNOTS thumbwheel or ALTITUDE-FEET thumbwheel remain out (step 6).	Defective lamp(s)	Check lamp and replace if defective.
3	Only one front panel edge lamp is lit (step 6).	Defective lamp	Check lighting panel assembly 134PEP81500–1 and replace if defective.
4	Both front panel edge lamps are off (step 6).	*a.* Defective connector 7J3 or 7P3	*a.* Check for continuity through connectors 7J3 and 7P3. If connectors 7J3 resistance is high, repair or replace defective connector. If connector 7P3 resistance is high, replace defective lighting panel assembly 134–PE81500–1.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		b. Defective front panel edge lamp(s)	*b.* Check lighting panel assembly 134PEP81500-1 and replace if defective.
5	AUTO FAIL indicator remains out and does not flash (step 7).	*a.* Defective 0.5 AMP fuse 7F1	*a.* Check fuse and replace if defective.
		b. Defective fuse holder	*b.* Check for terminal continuity through fuse holder. If terminal resistance is high, replace defective fuse holder.
		c. Defective POWER switch 7S1	*c.* Check switch and replace if defective.
		d. Defective module 7A1	*d.* Check for –3.3 ±0.5 volts dc at 7A1TP5 and +4.7 ±1 volts dc at 7A1TP4. If voltages are incorrect, replace defective module.
		e. Defective module 7A5	*e.* Replace module.
		f. Same as item No. 1	*f.* Same as item No. 1.
6	AUTO FAIL indicator does not flash but is lit constantly (step 7).	*a.* Defective module 7A5	*a.* Replace module.
		b. Same as item No. 1	*b.* Same as item No. 1.
7	AUTO FAIL indicator does not stop flashing (step 8).	*a.* Defective PRESS TO RESET switch 7S3.	*a.* Check switch and replace if defective.
		b. Defective module 7A5	*b.* Replace module.
8	AUTO FAIL indicator goes out (step 8).	Defective module 7A5	Replace module.
9	AUTO FAIL indicator remains lit (step 9).	*a.* Defective AUTO FAIL TEST switch 7S4.	*a.* Check continuity across switch. If switch resistance is high, replace defective switch.
		b. Defective resistor 7R5	*b.* Check resistance of 7R5 for 240 ±12 ohms. Replace if defective.
		c. Defective module 7A5	*c.* Replace module.
		d. Same as item no. 1	*d.* Same as item No. 1.
10	AUTO FAIL indicator remains off (step 10).	*a.* Defective module 7A5	*a.* Replace module.
		b. Same as item No. 1	*b.* Same as item No. 1.
11	AUTO FAIL indicator is not lit constantly (step 11).	Defective module 7A5	Replace module.
12	AUTO FAIL indicator brightness does not decrease (step 12).	*a.* Defective module 7A5	*a.* Replace module.
		b. Same as item No. 1	*b.* Same as item No. 1.
13	AUTO FAIL indicator goes out (step 12).	Defective module 7A5	Replace module.
14	AUTO FAIL indicator does not go out (step 13).	Defective module 7A5	Replace module.
15	AUTO FAIL indicator does not flash (step 14).	*a.* Defective AUTO FAIL TEST switch 7S4.	*a.* Check switch and replace if defective.
		b. Defective capacitor 7C14	*b.* Check capacitor and replace if defective.
16	AUTO FAIL indicator does not go out (step 15).	*a.* Defective AUTO FAIL TEST switch 7S4.	*a.* Check switch and replace if defective.
		b. Defective module 7A5	*b.* Replace module.
17	Multimeter does not indicate 0 volt dc (step 16).	*a.* Defective OVERRIDE switch 7S2	*a.* Check switch and replace replace if defective.
		b. Defective capacitor 7C12	*b.* Check capacitor and replace if defective.
18	Multimeter indicates less than +26.5 volts dc (step 17).	*a.* Same as item No. 17*a*	*a.* Same as item No. 17*a*.
		b. Defective resistor 7R3	*b.* Check resistance of 7R3 for 20 ±1.0 ohms. Replace if defective.
		c. Same as item No. 1	*c.* Same as item No. 1.
19	Multimeter does not indicate from +98 and to +102	*a.* Defective module 7A1	*a.* Check for –24 ±5 volts dc at 7A1TP1, –110 ±20 volts dc at

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
19 (Cont)	volts dc (step 19).		7A1TP2, and +150 ±20 volts dc at 7A1TP6. If voltages are out of tolerance, replace defective module.
		b. Defective module 7A5	*b.* Check for –6 ±1 vdc at 7TP8 and +128 ±5 volts dc at 7TP9. If voltages are not correct, replace defective module.
		c. Defective ALTITUDE-FEET thumbwheels.	*c.* Replace thumbwheels.
		d. Defective VELOCITY-KNOTS thumbwheels.	*d.* Replace thumbwheels.
20	Multimeter does not indicate from +48 to +52 volts dc (step 21).	Same as item No. 19	Same as item No. 19.
21	Multimeter does not indicate from +0.4 to +0.6 volts dc (step 23).	Same as item No. 19	Same as item No. 19.

c. Voltage and Resistance (V & R) Measurements.

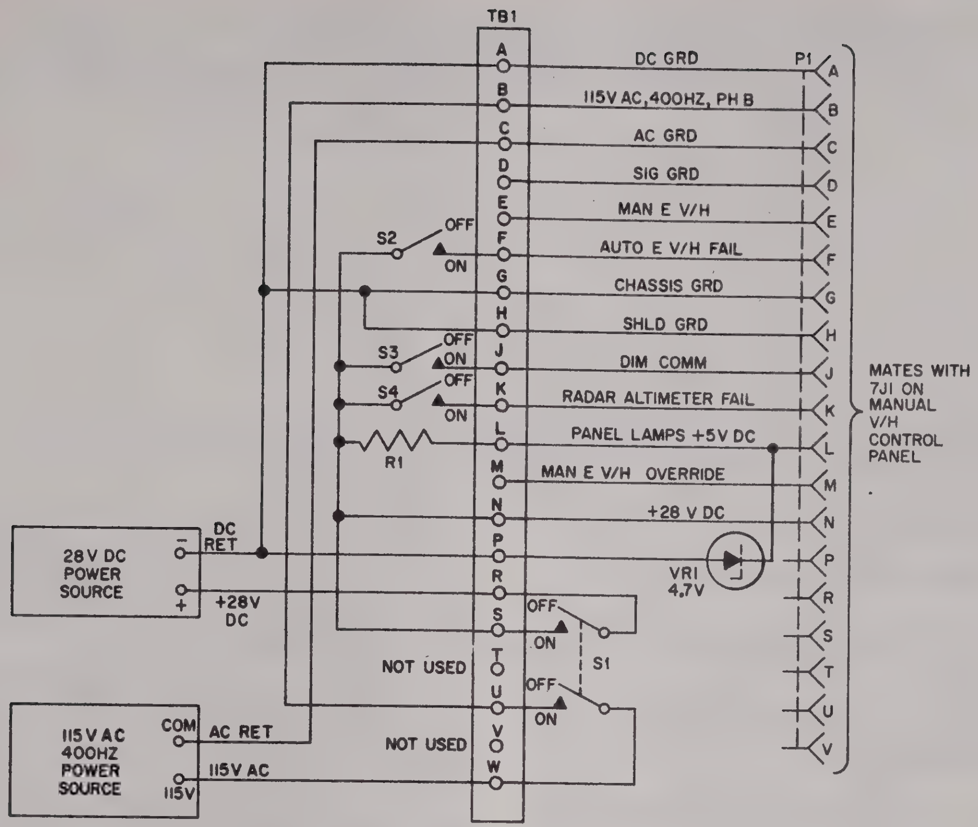
(1) *Voltage measurements.* The voltage measurements listed in the following chart are obtained with the manual V/H control panel connected in the test cable shown in figure 3–1. Switches S1, S2, S3, and S4 on the test cable (fig. 3–1) all are in the on (closed) position. On the manual V/H control panel, the POWER switch 7S1 is in the ON position, the VELOCITY-KNOTS thumbwheels are in the 100 position, and the ALTITUDE-FEET thumbwheels are in the 00100 position. Voltage measurements for connector 7J1 on the manual V/H control panel are obtained at the corresponding terminal on test cable terminal board TB1. The following voltage chart lists the TB1 terminal and also gives the corresponding pin on connector 7J1 in parentheses. The voltage measurements are obtained using a multimeter.

WARNING

Be careful when making connections to terminal board TB1 on test cable. Dangerous voltages of 115 volts ac, 400 Hz and +28 volts dc are present at terminals.

Multimeter		Range	Voltage
+	–		
7A1TP4	7A1TP3	10 vdc	+4 to +6 vdc
7A1TP3	7A1TP5	10 vdc	–2.64 to –3.96 vdc
7A1TP7	7A1TP1	50 vdc	–19 to –29 vdc
7A1TP7	7A1TP2	250 vdc	–90 to –130 vdc
7A1TP6	7A1TP7	250 vdc	+130 to +170 vdc
7TP9	7A1TP7	250 vdc	+123 to +133 vdc
7TP10	7A1TP7	250 vdc	+48 to +52 vdc
7A1TP7	7A1TP8	10 vdc	–4 to –6 vdc
TB1–F (7J1–F)	TB1–A (7J1–A)	50 vdc	+26.5 to +29.5 vdc
TB1–G (7J1–G)	TB1–A (7J1–A)	2.5 vdc	0 vdc
TB1–H (7J1–H)	TB1–A (7J1–A)	2.5 vdc	0 vdc
TB1–J (7J1–J)	TB1–A (7J1–A)	50 vdc	+26.5 to +29.5 vdc
TB1–K (7J1–K)	TB1–A (7J1–A)	50 vdc	+26.5 to +29.5 vdc
TB1–L (7J1–L)	TB1–A (7J1–A)	10 vdc	+3.7 to +5.7 vdc
TB1–M (7J1–M)	TB1–A (7J1–A)	2.5 vdc	0 vdc[a]
TB1–M (7J1–M)	TB1–A (7J1–A)	50 vdc	+26.5 to 29.5 vdc[b]
TB1–N (7J1–N)	TB1–A (7J1–A)	50 vdc	+26.5 to 29.5 vdc
TB1–B (7J1–B)	TB1–C (7J1–C)	250 vdc	110 to 120 vac
TB1–E (7J1–E)	TB1–D (7J1–D)	250 vdc	+48 to +52 vdc

[a] The following indication is obtained with OVERRIDE switch 7S2 in MANUAL position.
[b] The following indication is obtained with OVERRIDE switch 7S2 in AUTO position.



NOTES:

1. USE THE FOLLOWING PARTS:

PART	DESCRIPTION OR MIL STANDARD
SWITCH: S1	MS25103-24
SWITCH: S2 S3, S4	MS35058-22
TERMINAL BOARD, TB1	MS27212-1-20
RESISTOR: R1	RW24V100 10 OHMS ±10% 91 W, WIRE WOUND
ZENER DIODE: VR1	IN1600
WIRE	NO. 18 AWG
CONNECTOR: P1	MS3126F-14-19S

2. USE CONVENIENT LENGTHS WIRE AS REQUIRED.
3. PART AND TERMINAL DESIGNATIONS ARE FOR REFERENCE PURPOSES ONLY.

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Figure 3-1. Manual V/H control panel, cable fabrication diagram and test setup.

(2) *Resistance measurements.* The resist-e measurements in the following chart are ained with no power applied to the manual V/H control panel and with no external connections to connector 7J1. A multimeter is used to make the following resistance measurements.

Multimeter		Range (ohms).	Resistance (ohms)
+	−		
7J1–B	7J1–C	----	a
7J1–N	7J1–M	----	b
7J1–D	7J1–E		
7J1–E	7J1–D		0
7J1–G	7J1–H	RX1	0
7J1–A	7J1–C	RX1	
7J1–A	7J1–F		
7J1–A	7J1–G		
7J1–A	7J1–H		
7J1–A	7J1–J		
7J1–A	7J1–K		
7J1–A	7J1–L		

[a] The following resistance measurement is made with the POWER switch 7S1 in ON position.
[b] The following resistance measurement is made with the OVERRIDE switch 7S2 in AUTO position.

Figure 3–2. Manual V/H control panel, schematic diagram.
[Located in back of manual]

Figure 3–3. Manual V/H control panel, wiring diagram.
[Located in back of manual]

3–6. Photo Junction Panel (Unit 8) Troubleshooting

Direct support troubleshooting procedures for the photo junction panel are given below.

a. Operational Check.

(1) Fabricate a test cable as shown in figure 3–4 to permit application of +28 volts dc to the relay coils of the photo junction panel. Do not turn on the +28-volt dc power source and do not connect the test leads.

(2) Using a multimeter on RX1 ohms range, check for continuity between the following relay contacts of right door actuator relay 8K2, left door actuator relay 8K3, and vertical door actuator relay 8K4 with the relays deenergized. See figure 3–5.

(*a*) Terminals A2 and A3.
(*b*) Terminals B2 and B3.
(*c*) Terminals C2 and C3.
(*d*) Terminals D2 and D3.

(3) Connect the test leads fabricated in (1) above to terminals X1 and X2 of doors ground safety relay 8K1.

(4) Turn on the +28 volt dc power supply. Using a multimeter on RX1 ohms range, check between relay contacts A1 and A2 of doors ground safety relay 8K1 for continuity to insure the relay is energized.

(5) Turn off the +28-volt dc power supply and transfer the test leads from relay 8K1 to terminals X1 and X2 on right door actuator relay 8K2.

(6) Turn on the +28-volt dc power supply. Using a multimeter on RX1 ohms range, check between the following relay contacts of right door actuator relay 8K2 for continuity to insure the relay is energized.

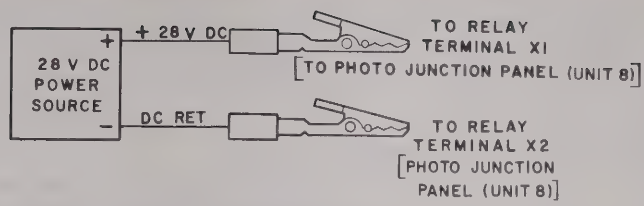
(*a*) Terminals A1 and A2.
(*b*) Terminals B1 and B2.
(*c*) Terminals C1 and C2.
(*d*) Terminals D1 and D2.

(7) Repeat steps (5) and (6) above to check left door actuator relay 8K3 and vertical door actuator relay 8K4.

(8) Turn off the +28-volt dc power supply and disconnect the test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts referenced in the troubleshooting chart and associated circuits are shown in the wiring diagram (fig. 3–5).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	No continuity of relay contact(s) (step 2).	Defective relays 8K2, 8K3, 8K4	Check relay(s) and replace if defective.
2	No continuity of relay contact(s) (step 4).	Defective relay 8K1	Check relay and replace if defective.
3	No continuity of relay contacts (step 6).	Defective relay 8K2	Check relay and replace if defective.
4	No continuity of relay contacts (step 7).	Defective coil and/or contacts on relays 8K3 or 8K4.	Check relay(s) and replace if defective.



NOTES:

1. USE THE FOLLOWING PARTS.

PART	DESCRIPTION OR MIL STANDARD
ELECTRICAL CLIPS	TYPE TCI PER FED SPECIFICATION W-C-440
WIRE	NO. 16 AWG

2. USE CONVENIENT LENGTHS OF WIRE AS REQUIRED

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Figure 3-4. Photo junction panel, cable fabrication diagram and test setup.

. Voltage and Resistance (V & R) Measure-nts.

(1) *Voltage measurements.* Not applicable.

(2) *Resistance measurements.* The resist-e measurements in the following chart are ained with no power applied to the photo iction panel and with no external connections terminal boards 8TB82 through 8TB86. A ltimeter is used to make the following resist-e measurements.

Multimeter +	Multimeter −	Range	Resistance (ohms)
382-9	8TB82-10	RX1	0
382-14	8TB82-16	RX10,000	midscale deflection to infinite.
382-16	8TB86-15	RX1	0
383-9	8TB83-10	RX1	0
383-15	8TB83-16	RX1	0
384-2	8K1-X1	RX100	500 (min)
384-4	8TB85-11	RX1	0
384-10	8TB84-11	RX1	0
384-12	8TB84-13	RX1	0
384-14	8TB84-15	RX1	0
385-1	8K1-A3	RX1	0
385-2	8K1-A1	RX1	0
385-3	8K3-A3	RX1	0
385-4	8K3-A1	RX1	0
385-5	8K4-A3	RX1	0
385-6	8K4-A1	RX1	0
85-7	8K2-X1	RX100	500 (min)
85-8	8K3-X1	RX100	500 (min)
85-9	8K4-X1	RX100	500 (min)
85-11	8TB84-4	RX1	0
85-13	8TB85-11	RX1	24 to 38
85-11	8TB85-13	RX10,000	Infinite

Multimeter +	Multimeter −	Range	Resistance (ohms)
8TB86-1	8K3-B1	RX1	0
8TB86-1	8K2-B1	RX1	0
8TB86-1	8K4-B1	RX1	0
8TB86-2	8K2-C1	RX1	0
8TB86-2	8K3-C1	RX1	0
8TB86-2	8K4-C1	RX1	0
8TB86-3	8K2-A2	RX1	0
8TB86-3	8K3-A2	RX1	0
8TB86-4	8K1-A1	RX1	0
8TB86-4	8K4-A2	RX1	0
8TB86-5	8K1-A2	RX1	0
8TB86-6	8K4-B2	RX1	0
8TB86-7	8K4-C2	RX1	0
8TB86-8	8K3-B2	RX1	0
8TB86-9	8K3-C2	RX1	0
8TB86-10	8K2-B2	RX1	0
8TB86-11	8K2-C2	RX1	0
8TB86-12	8TB86-13, 14, 15	RX1	0
8TB86-15	KA76-107A16N Ground stud	RX1	0

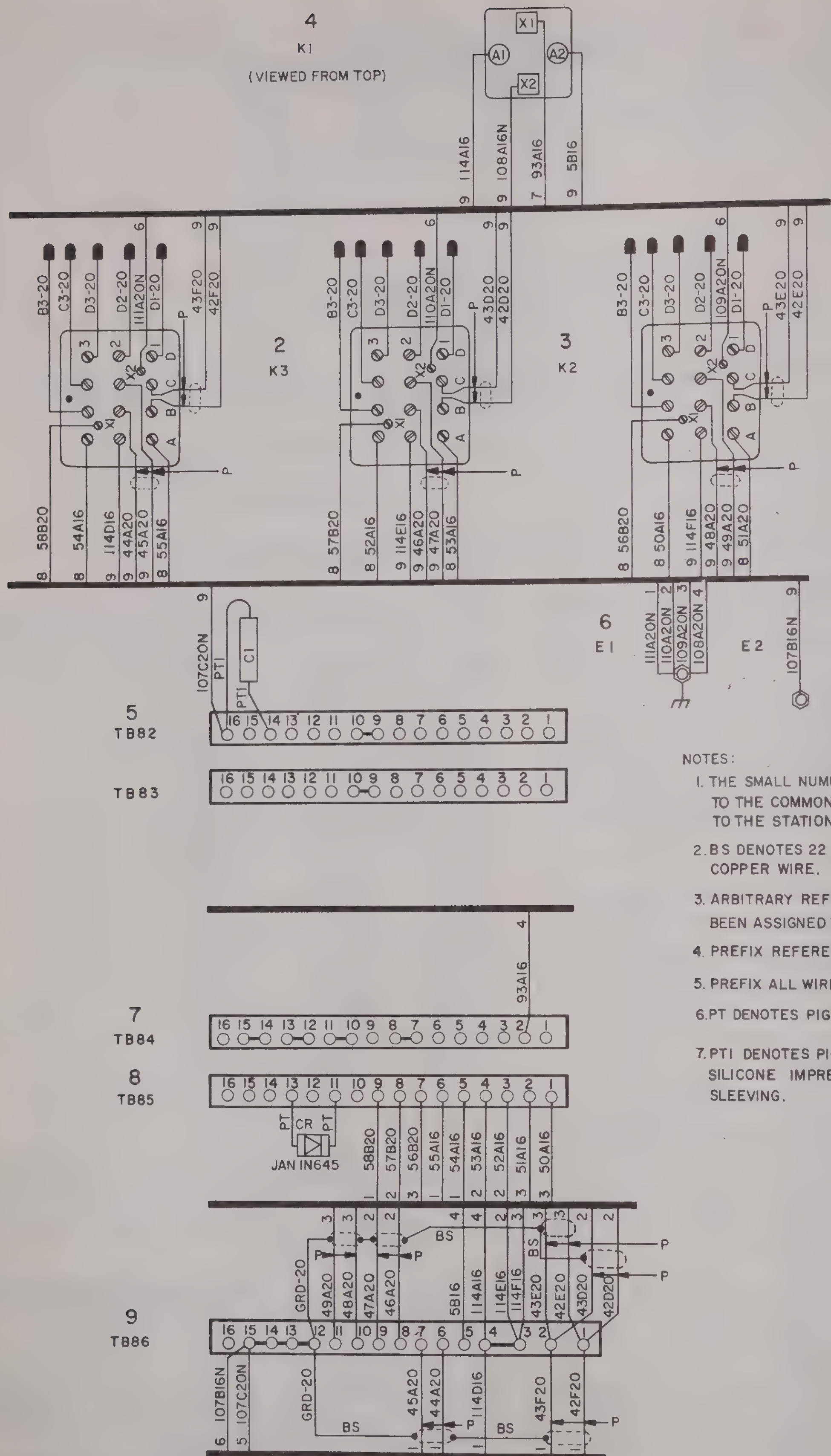
3-7. Photo Control Panel (Unit 3) Troubleshooting

Direct support troubleshooting procedures for the photo control panel are given below.

a. Operational Check.

(1) Fabricate a test cable as shown in figure 3-6. Do not make connections to the +28-volt dc power source and 6 volt battery.

(2) Set switches S1, S2 and S4 through S6 on test cable to their off positions.



NOTES:

1. THE SMALL NUMBERS ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPOND TO THE STATION TO WHICH THE WIRE RUNS.
2. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRE.
3. ARBITRARY REFERENCE DESIGNATORS HAVE BEEN ASSIGNED TO ALL ITEMS.
4. PREFIX REFERENCE DESIGNATORS WITH 8.
5. PREFIX ALL WIRE NUMBERS WITH KA-76.
6. PT DENOTES PIGTAIL LEAD.
7. PT1 DENOTES PIGTAIL LEAD INSULATED WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.

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Figure 3-5. Photo junction panel, wiring diagram.

(3) Connect the fabricated test cable to onnector 3J1 of the photo control panel.

(4) Connect test cable (fig. 3-6) to +28-olt dc power source and 6 volt battery.

(5) Turn on dc power source. Allow 15 inutes for warm up.

(6) Set switch S4 on test cable to its on closed) position, and momentarily depress EADY and OPERATE indicators 3DS2 and DS1 on the photo control panel. Both indica-ors should light momentarily.

(7) Set V/H switch 3S1 on photo control anel to MANUAL position and set switch S1 n test cable to its on (closed) position. Lamp S1 on the test cable should light.

(8) Set V/H switch 3S1 on photo control anel to AUTO position. Lamp DS1 on test able should go out momentarily and then light gain.

(9) Return switch S1 on test cable to its off open) position. Lamp DS1 on test cable should o out.

(10) Set MOUNT switch 3S2 on photo con-rol panel to L15° position and set switch S2 on est cable to its on (closed) position. Lamp DS2 n test cable should light.

(11) Set MOUNT switch 3S2 on photo con-rol panel to L30° position. Lamp DS2 on test able should go out momentarily and then light gain.

(12) Set MOUNT switch 3S2 on photo con-rol panel to 90° position. Lamp DS2 on test able should go out and remain off.

(13) Set MOUNT switch 3S2 on photo con-rol panel to R30° position. Lamp DS2 on test able should light.

(14) Set MOUNT switch 3S2 on photo con-rol panel to R15° position. Lamp DS2 on test able should go out momentarily and then light gain.

(15) Return MOUNT switch 3S2 on photo ontrol panel to 90° position and switch S2 on est cable to its off (open) position.

(16) Set MODE switch 3S3 on photo control anel to AUTO position. Lamp DS3 on test cable hould remain out.

(17) Set MODE switch 3S3 on photo control anel to PULSE position. Lamp DS3 on test able should light.

(18) Repeat step (17) with MODE switch 3S3 on photo control panel set to PULSE IMC, and then the NIGHT position.

(19) Return MODE switch 3S3 on photo control panel to AUTO position. Lamp DS3 on test cable should go out.

NOTE

Note the FRAMES REMAINING counter 3M1 reading on the photo control panel.

(20) Momentarily depress switch S3 on test cable. The OPERATE indicator 3DS1 on photo control panel should light and FRAMES REMAINING counter 3M1 should subtract one digit.

(21) Set switch S5 on test cable to its on (closed) position. The READY indicator 3DS2 on photo control panel should light.

(22) Set switch S5 on test cable to its off (open) position. The READY indicator 3DS2 should go out.

(23) Set SYS PWR switch 3S4 on photo control panel to READY position. Lamp DS4 on test cable should light.

(24) Set SYS PWR switch 3S4 on photo control panel to OPERATE position. Lamps DS3 and DS4 on test cable should light.

(25) Set SYS PWR switch 3S4 on photo control panel to OFF position. Lamps DS3 and DS4 on test cable should go out.

(26) Set switch S6 on test cable to its on (closed) position. Panel lights on photo control panel should light.

(27) Set switch S6 on test cable to its off (open) position. Panel lights on photo control panel should go out.

(28) Turn off the +28 volt dc power source and disconnect the test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts referenced in the troubleshooting chart and associated circuits are shown in the schematic diagram (fig. 3-7) and the wiring diagram (fig. 3-8).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	When depressed, OPERATE indicator 3DS1 and READY indicator 3DS2 do not light (step 6).	*a.* Defective OPERATE indicator 3DS1 and READY indicator 3DS2.	*a.* Check indicator(s) and replace if defective.
		b. Defective coil 3L1	*b.* Check coil and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		c. Defective wiring between coil 3L1 and connector pin A of connector 3J1.	*c.* Repair or replace wiring if defective.
2	When depressed, OPERATE indicator 3DS1 lights but READY indicator 3DS2 remains off (step 6).	*a.* Defective READY indicator 3DS2 *b.* Defective wiring between READY indicator 3DS2 and connector pin R of connector 3J1 or coil 3L1.	*a.* Check indicator and replace if defective. *b.* Repair or replace wiring if defective.
3	When depressed, READY indicator 3DS2 lights but OPERATE indicator 3DS1 remains off (step 6).	*a.* Defective OPERATE indicator 3DS1. *b.* Defective filter FL1 *c.* Defective wiring between filter 3FL1 and OPERATE indicator 3DS1.	*a.* Check indicator and replace if defective. *b.* Check filter and replace if defective. *c.* Repair or replace wiring if defective.
4	Lamp DS1 on test cable does not light (step 7).	*a.* Defective V/H switch 3S1 *b.* Defective wiring between V/H switch 3S1 and pin H of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
5	Lamp DS1 on test cable does not light (step 8).	*a.* Defective V/H switch 3S1 *b.* Defective wiring between V/H switch 3S1 and pin *c* of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
6	Lamp DS1 on test cable does not light with V/H switch 3S1 set to MANUAL or AUTO (steps 7 and 8).	*a.* Defective V/H switch 3S1 *b.* Defective wiring between V/H switch 3S1 and pin M of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
7	Lamp DS2 on test cable does not light (step 10).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring between MOUNT switch 3S2 and pin *q* of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
8	Lamp DS2 on test cable does not light (step 11).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring between MOUNT switch 3S2 and pin *b* of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
9	Lamp DS2 on test cable does not light (step 13).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring between MOUNT switch 3S2 and pin C of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
10	Lamp DS2 on test cable does not light (step 14).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring between MOUNT switch 3S2 and pin *d* of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
11	Lamp DS2 on test cable does not light at any MOUNT switch 3S2 setting (steps 7 thru 11 and 13 thru 14).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring between MOUNT switch 3S2 and pin S of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
12	Lamp DS3 on test cable does not light (step 17).	*a.* Defective MODE switch 3S3 *b.* Defective wiring between MODE switch 3S3 and pin P of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
13	Lamp DS3 on test cable does not light when MODE switch 3S3 on photo control panel is set at PULSE IMC position (step 18).	*a.* Defective MODE switch 3S3 *b.* Defective wiring between MODE switch 3S3 and pin B of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
14	Lamps DS3 on test cable does	*a.* Defective MODE switch 3S3	*a.* Check switch and replace if defective.

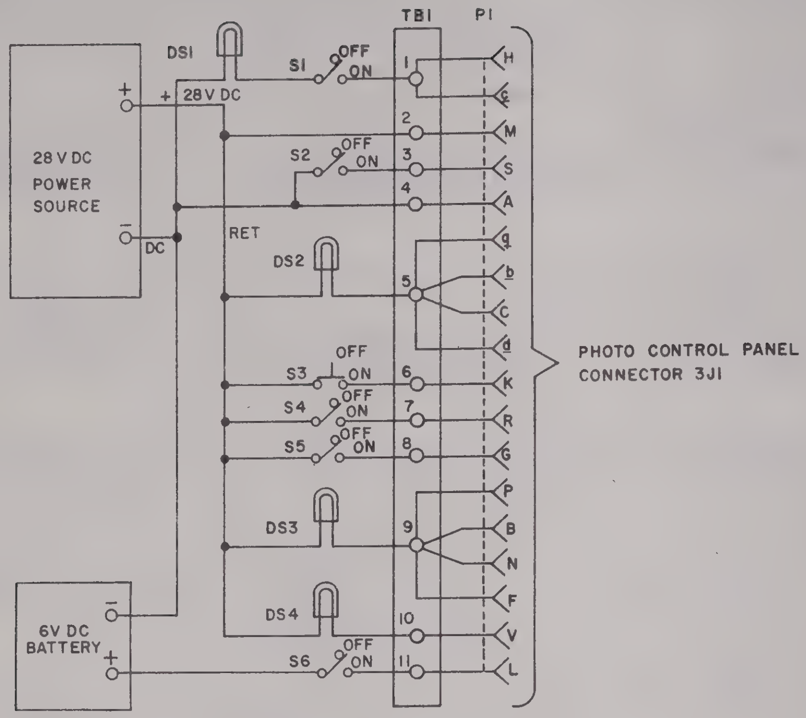
Item No.	Trouble symptom	Probable cause	Checks and corrective measures
	not light when MODE switch 3S3 on photo control panel is set at NIGHT position (step 18).	*b.* Defective wiring between MODE switch 3S3 and pin N of connector 3J1.	*b.* Repair or replace wiring if defective.
15	Lamp DS3 on test cable does not light for any setting of MODE switch 3S3 on photo control panel (step 17 and 18).	*a.* Defective MODE switch 3S3 *b.* Defective wiring between MODE switch 3S3 and coil 3L1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
16	FRAMES REMAINING counter 3M1 on photo control panel operates but OPERATE indicator does not light (step 20).	*a.* Defective OPERATE indicator 3DS1. *b.* Defective wiring between OPERATE indicator 3DS1 and junction of 3M1 and diode 3CR11.	*a.* Check indicator and replace if defective. *b.* Repair or replace wiring if defective.
17	OPERATE indicator 3DS1 on photo control panel lights but FRAMES REMAINING counter does not operate (step 20).	*a.* Defective FRAMES REMAINING counter 3M1. *b.* Defective wiring between FRAMES REMAINING counter 3M1 and filter 3FL1.	*a.* Check counter and replace if defective. *b.* Repair or replace wiring if defective.
18	FRAMES REMAINING counter does not operate and OPERATE indicator on photo control panel does not light (step 20).	Defective wiring between pin K of connector 3J1 and junction of FRAMES REMAINING counter 3M1 and OPERATE indicator 3DS1.	Repair or replace wiring if defective.
19	READY indicator 3DS2 on photo control panel does not light (step 21).	*a.* Defective READY indicator 3DS2 *b.* Defective wiring between READY indicator 3DS2 and pin G of connector 3J1.	*a.* Check indicator and replace if defective. *b.* Repair or replace wiring if defective.
20	Lamp DS4 on test cable does not light (step 23).	*a.* Defective SYS PWR switch 3S4 *b.* Defective wiring between SYS PWR switch 3S4 and pin V of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
21	Lamp DS3 on test cable does not light (step 24).	*a.* Defective SYS PWR switch 3S4 *b.* Defective wiring between SYS PWR switch 3S4 and pin F of connector 3J1.	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
22	Panel lamps on photo control panel do not light (step 26).	*a.* Defective panel lamp assembly 3A1. *b.* Defective wiring between panel lamp assembly 3A1 and pin L of connector 3J1.	*a.* Check panel lamp assembly and replace if defective. *b.* Repair or replace wiring if defective.

c. Voltage and Resistance (V&R) Measure- ents.

(1) *Voltage measurements.* The voltage easurements listed in the following chart are btained with the photo control panel connected the test cable shown in figure 3–6. Switches S1 id S2, and S4 through S6 on the test cable (fig. -6) are set to the on (closed) position. On the ioto control panel, the V/H switch 3S1 is set the AUTO position, the MOUNT switch 3S2 set at the L15° position, the MODE switch 33 is set at the AUTO position, and the SYS PWR switch 3S4 is set at the OFF position. Voltage measurements for connector 3J1 on the photo control panel are obtained at the corresponding terminal on test cable terminal board TB1. The following chart lists the TB1 terminal and also gives the corresponding pin on connector 3J1 in parentheses. The voltage measurements are obtained using a multimeter.

WARNING

Be careful when making connections to terminal board TB1 on test cable. Dangerous voltages of +28 volts dc are present at terminal.



NOTES

1. USE THE FOLLOWING PARTS:

PART	DESCRIPTION OR MIL STANDARD
CONNECTOR: P1	MS3126F-18-32S
LAMP SOCKET: XDS1 THRU XDS4	MS90287-8
LAMP: DS1 THRU DS 4	MS25231-313
SWITCH: S1, S2 S4, S5, S6	MS24655-221
SWITCH: S3	MS25089-1A (MIL-S-8805/3)
TERMINAL BOARD TB1	MS27212-1-11
WIRE:	NO: 22 AWG

2. USE CONVENIENT LENGTHS OF WIRE AS REQUIRED.
3. PART AND TERMINAL DESIGNATIONS ARE ASSIGNED FOR REFERENCE PURPOSES ONLY.

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Figure 3-6. Photo control panel, cable fabrication diagram and test setup.

Multimeter +	Multimeter –	Range	Voltage
TB1-6 (3J1-K)	TB1-4(3J1-A)	50 vdc	0 vdc
TB1-6 (3J1-K)	TB1-4(3J1-A)	50 vdc	+26.5 to +29.5 vdc[a]
TB1-10(3J1-V)	TB1-3(3J1-S)	50 vdc	0 vdc
TB1-10(3J1-V)	TB1-3(3J1-S)	50 vdc	+26.5 to +29.5 vdc[b]
TB1-9 (3J1-P, B, N, F)	TB1-3(3J1-S)	50 vdc	0 vdc
TB1-9 (3J1-P, B, N, F)	TB1-3(3J1-S)	50 vdc	+26.5 to 29.5 vdc[c]
TB1-11(3J1-L)	TB1-4(3J1-A)	10 vdc	+5.5 to +6.5 vdc[d]

[a]Voltage obtained with switch S3 on test cable depressed.
[b]Voltage obtained with switch S2 on test cable set to on (closed) position and SYS PWR switch 3S4 on photo control panel set to READY position.
[c]Voltage obtained with switch S2 on test cable set to on (closed) position and SYS PWR switch 3S4 on photo control panel set to OPERATE position.
[d]Voltage obtained with switch S6 on test cable set to on (closed) position.

(2) *Resistance measurements.* The resist-
ance measurements in the following chart are obtained with no power applied to the photo control panel, with no external connections to connector 3J1, and with the controls set to the same positions as in (1) above. A multimeter is used to make the following resistance measurements.

Multimeter +	Multimeter -	Range	Resistance (ohms)
J1–A	3J1–K		
J1–A	3J1–G		
J1–A	3J1–R	RX10,000	Infinite
J1–A	3J1–R	RX1	[a]
J1–A	3J1–R	RX1	[b]
J1–A	3J1–P	RX10,000	Infinite
J1–A	3J1–P	RX1	4.0[c]
J1–A	3J1–B	RX1	4.0[d]
J1–A	3J1–N	RX1	4.0[e]
J1–A	3J1–V	RX10,000	Infinite
J1–A	3J1–V	RX1	4.0[f]
J1–A	3J1–F	RX10,000	Infinite
J1–A	3J1–F	RX1	4.0[g]
J1–A	3J1–L	RX1	
J1–M	3J1–*c*	RX1	0
J1–M	3J1–H	RX10,000	Infinite
J1–M	3J1–H	RX1	0[h]
J1–J	3J1–W	RX1	0
J1–J	3J1–D,E,F, T,U,X,Y, Z,*e,f,g,h, j.*	RX10,000	Infinite

[a]Resistance taken with OPERATE indicator 3DS1 depressed.
[b]Resistance taken with READY indicator 3DS2 depressed.
[c]Resistance taken with MODE switch 3S3 set at PULSE position.
[d]Resistance taken with MODE switch 3S3 set at PULSE IMC position.
[e]Resistance taken with MODE switch 3S3 set at NIGHT position.
[f]Resistance taken with SYS PWR switch 3S4 at READY position.
[g]Resistance taken with SYS PWR switch 3S4 set at OPERATE position.
[h]Resistance taken with V/H switch 3S1 set at MANUAL position.

Figure 3–7. Photo control panel, schematic diagram.
[Located in back of manual]

3–8. Photo System Assembly (Unit 1) Troubleshooting

Direct support troubleshooting procedures for the photo system assembly are given below.

a. Operational Check.

WARNING

Make sure that 115-volt ac, three-phase, 400-Hz, and +28-volt dc power sources are off before performing steps (1) through (4), below. Dangerous voltages of 115 volts ac and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate a test cable as shown in figure 3–9.

(2) Set switches S1 through S3 and S5 through S7 on test cable to their off positions.

(3) Connect the test cable to connectors 1J1 and 1J2 on photo system assembly.

(4) Connect test cable (fig. 3–9) to 115-volt ac and +28-volt dc power sources.

(5) Turn on ac and dc power sources. Allow 15 minutes for warmup.

(6) Set switch S1 of test cables to on (closed) position. Lamp DS3 on test cable should light.

(7) Set multimeter to 250-volt ac range.

(8) Set switch S2 on test cable to on (closed) position, and connect positive lead of multimeter to terminal 21 of test cable terminal board TB1. Connect negative lead of multimeter to terminal 1. Multimeter should indicate from 109 to 116.5 volts ac.

(9) Connect positive lead of multimeter to terminal 19 on test cable terminal board TB1. Multimeter should indicate from 109 to 116.5 volts ac.

(10) Set switch S2 on test cable to off (open) position. Multimeter should indicate 0 volt ac.

(11) Set switch S3 on test cable to on (closed) position, and connect positive lead of multimeter to terminal 20 on test cable terminal board TB1. Multimeter should indicate from 109 to 116.5 volts ac.

(12) Set switch S3 on test cable to off (open) position, then disconnect multimeter from test cable terminal board TB1.

(13) Momentarily depress switch S4 on test cable. Lamp DS1 on test cable should light momentarily.

(14) Momentarily depress switch S8 on test cable. Lamps DS1 and DS2 on test cable should light momentarily.

(15) Sequentially set switches S5, then S6 on test cable to on (closed) positions. Lamp DS2 should light.

(16) Using a multimeter on RX1 ohms range, check for continuity between terminals 11 and 18 on test cable terminal board TB1.

(17) Set switch S5 on test cable to off (open) position. Lamp DS2 on test cable should go out.

(18) Sequentially set switch S5, then S7 on test cable to on (closed) position. Lamp DS2 should light.

(19) Repeat step (16) above.

(20) Set switches S1, S5, S6, and S7 on test cable to off (open) position. Lamps DS2 and DS3 on test cable should go out.

(21) Turn off ac and dc power sources and disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts referenced in the troubleshooting chart and associated circuits are shown in the schematic diagram (fig. 3-10) and the wiring diagram (fig. 3-14).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Lamp DS3 on test cable does not light (step 6).	*a.* Defective fuse 1F1	*a.* Check fuse and replace if defective.
		b. Defective relay 1K1	*b.* Momentarily depress switch S4 on test cable. If lamp DS1 on test cable does not light, replace defective relay.
		c. Defective filter 1FL7	*c.* If lamp DS1 on test cable did not light in *b* above, replace defective filter.
		d. Defective wiring	*d.* Repair or replace wiring if defective.
2	No 115-volt ac, phase B power indication on multimeter (step 8).	*a.* Defective fuse 1F2 or 1F4	*a.* Check fuse(s) and replace if defective.
		b. Defective relay 1K2	*b.* Momentarily depress switch S4 on test cable. If lamp DS1 on test cable does not light, replace defective relay.
		c. Defective filter 1FL4	*c.* If lamp DS1 on test cable did not light in b above, replace defective filter.
		d. Defective wiring	*d.* Repair or replace wiring if defective.
3	No 115-volt ac, phase A power indication on multimeter (step 9).	*a.* Defective fuse 1F3	*a.* Check fuse and replace if defective.
		b. Defective relay 1K2	*b.* Same as item No. 2*b*.
		c. Defective filter 1FL4	*c.* Same as item No. 2*c*.
		d. Defective wiring	*d.* Repair or replace wiring if defective.
4	No 115-volt ac phase C power indication on multimeter (step 9).	*a.* Defective fuse 1F5	*a.* Check fuse and replace if defective.
		b. Defective relay 1A3K7	*b.* Replace printed circuit board and component assembly module 1A3.
		c. Defective filter 1FL4	*c.* Check filter and replace if defective.
		d. Defective wiring	*d.* Repair or replace wiring if defective.
5	Lamp DS1 on test cable does not light (step 13).	*a.* Defective fuse 1F6	*a.* Check fuse and replace if defective.
		b. Defective filter 1FL1 or 1FL3	*b.* Check filter(s) and replace if defective.
		c. Defective relay 1A3K8, 1A3K9, 1A3K10, or 1A3K11.	*c.* Replace printed circuit board and component assembly module 1A3.
		d. Defective wiring	*d.* Repair or replace wiring if defective.
6	Lamps DS1 and DS2 on test cable do not light (step 14).	*a.* Defective diode 1CR8	*a.* Check diode and replace if defective.
		b. Defective relay 1K7	*b.* Check relay and replace if defective.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
7	Either lamp DS1 or DS2 on test cable lights while other lamp remains off (step 14).	*a.* Defective relay 1K7	*a.* Check relay and replace if defective.
		b. Defective wiring	*b.* Repair or replace wiring if defective.

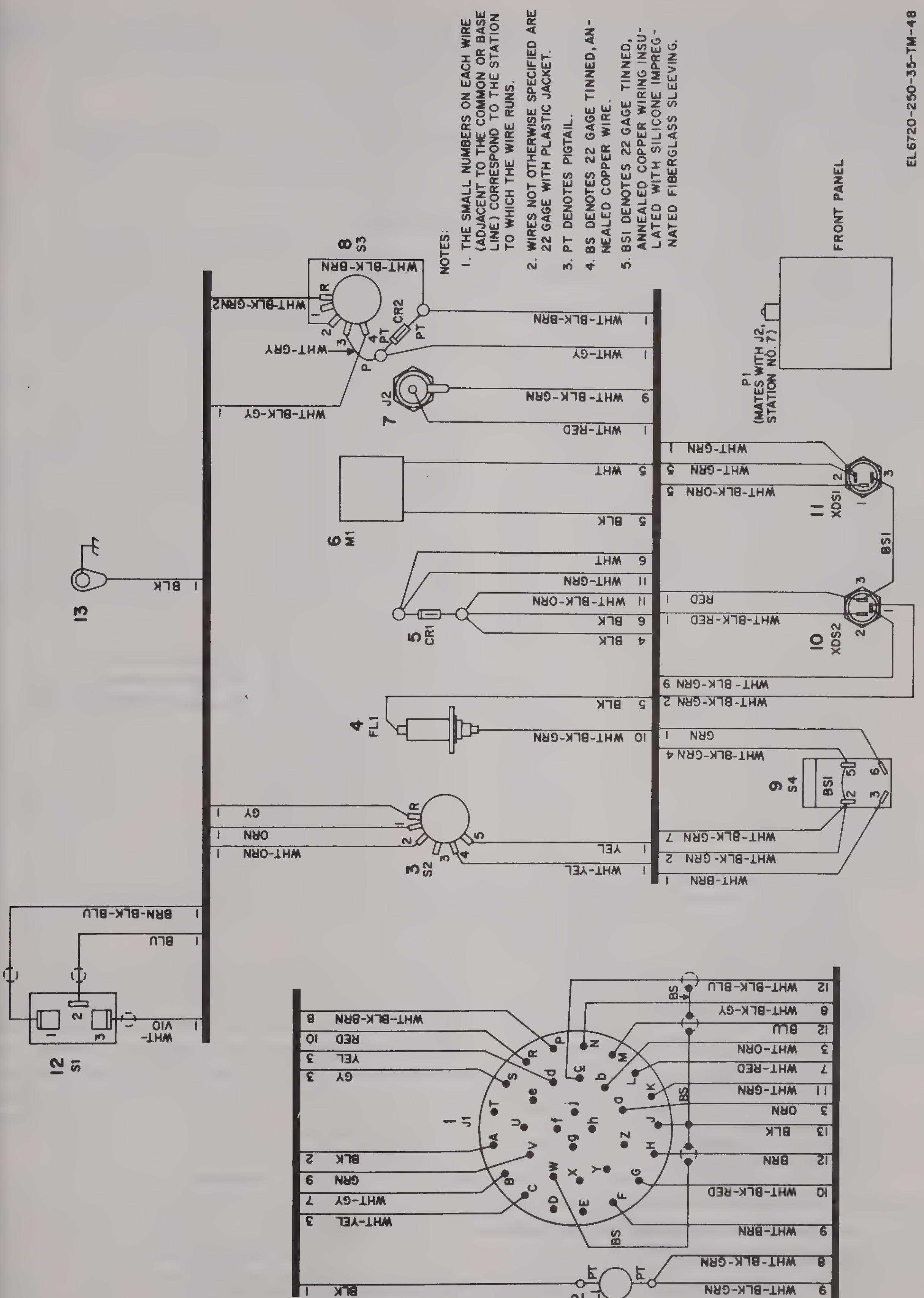
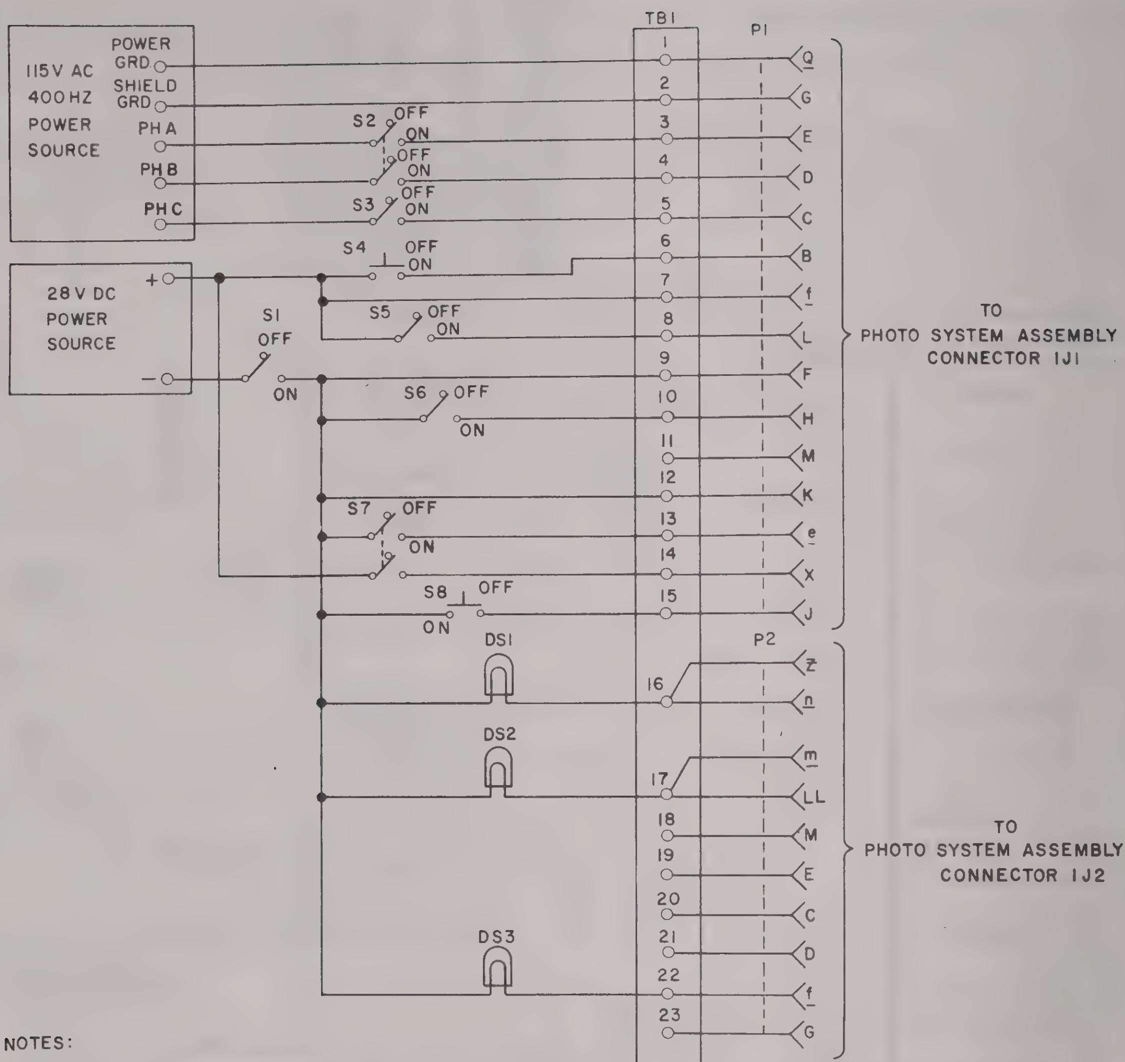


Figure 3-8. Photo control panel, wiring diagram.



NOTES:

1. USE THE FOLLOWING PARTS:

PART	DESCRIPTION OR MIL STD
CONNECTOR: P1	MS3106E-22-55P
CONNECTOR: P2	MS3106E-22-21S
LAMP: DS1, DS2, DS3	MS25231-313
LAMP SOCKETS XDS1, XDS2, XDS3	MS90287-8
SWITCHES S1, S3, S5, AND S6	MS24655-221
SWITCHES S2 AND S7	MS25103-24
SWITCHES S4 AND S8	MS25089-1A (MIL-S-8805/3)
TERMINAL BOARD: TB1	MS27212-1-23
WIRE (PWR GRD AND DC GRD +28 VDC POWER)	NO. 16 AWG
WIRE (AC PWR, SHIELD, GRD, AND DC GRD)	NO. 22 AWG

2. USE CONVENIENT LENGTHS OF WIRE AS REQUIRED.

3. PART AND TERMINAL DESIGNATIONS ARE ASSIGNED FOR REFERENCE PURPOSES ONLY.

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Figure 3-9. Photo system assembly, cable fabrication diagram and test setup.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
8	Lamp DS2 on test cable does not light (step 15).	*a.* Defective relay 1K3, 1K4, or 1K5 *b.* Defective wiring	*a.* Check relay(s) and replace if defective. *b.* Repair or replace wiring if defective.
9	Multimeter does not indicate continuity (step 16).	*a.* Defective relay 1K5 *b.* Defective wiring	*a.* Check relay and replace if defective. *b.* Repair or replace wiring if defective.
10	Lamp DS2 on test cable does not light (step 18).	*a.* Defective relay 1K4 or 1K6 *b.* Defective wiring	*a.* Check relay(s) and replace if defective. *b.* Repair or replace wiring if defective.

c. Voltage and Resistance (V & R) Measurements.

(1) *Voltage measurements.* The voltage measurements listed in the following chart are obtained with the photo system assembly connected to the test cable shown in figure 3–9. Switches S1, S2, and S3 on test cable (fig. 3–9) are all in the on (closed) position. Voltage measurements for connectors 1J1 and 1J2 on the photo system assembly are obtained at the corresponding terminals on test cable terminal board TB1. The following voltage chart lists the TB1 terminal and also gives the corresponding pin on connector 7J1 in parentheses. The voltage measurements are obtained using a multimeter.

WARNING

Be careful when making connections to terminal board TB1 on test cable. Dangerous voltages of 115 volts ac, 400 Hz and +28 volts dc are present at terminals.

Multimeter		Range	Voltage
+	–		
TB1–1 (1J1–*q*)	TB1–21 (1J2–D)	250 vac	110 to 120 vac
TB1–1 (1J1–*q*)	TB1–19 (1J2–E)	250 vac	110 to 120 vac
TB1–1 (1J1–*q*)	TB1–20 (1J2–C)	250 vac	110 to 120 vac
TB1–9 (1J1–F)	TB1–22 (1J2–*f*)	50 vdc	+26.5 to +29.5 vdc
TB1–9 (1J1–F)	TB1–16 (1J2–Z)	50 vdc	+26.5 to +29.5 vdc[c]
TB1–9 (1J1–F)	TB1–16 (1J2–*n*)	50 vdc	+26.5 to +29.5 vdc[a]
TB1–9 (1J1–F)	TB1–17 (1J2–*m*)	50 vdc	+26.5 to +29.5 vdc[a]
TB1–9 (1J1–F)	TB1–17 (1J2–LL)	50 vdc	+26.5 to +29.5 vdc[b]

[a]Voltage obtained with switch S8 on test cable depressed momentarily.
[b]Voltage obtained with switches S5 and S6 on test cable closed.
[c]Voltage obtained with switch S4 on test cable depressed momentarily.

(2) *Resistance measurements.* The resistance measurements in the following chart are obtained with no power applied to the photo system assembly and with no external connections to connectors 1J1, 1J2, and 1J3. A multimeter is used to make the following resistance measurements.

Figure 3–10. Photo system assembly, schematic diagram.
[Located in back of manual]

Figure 3–11. Film drive amplifier module 1A2, schematic diagram.
[Located in back of manual]

Figure 3–12. Intervalometer module 1A1, schematic diagram.
[Located in back of manual]

Figure 3–13. PC board and component assembly module 1A3, schematic diagram.
[Located in back of manual]

Figure 3–14(1). Photo system assembly, wiring diagram (sheet 1 of 2).
[Located in back of manual]

Figure 3–14(2). Photo system assembly, wiring diagram (sheet 2 of 2).
[Located in back of manual]

Multimeter		Range	Resistance (ohms)
+	–		
1J1–A	1J2–A	RX1	0
1J1–A	1J1–H	RX1	0
1J1–A	1J3–A	RX1	0
1J1–H	1J2–*f*	RX100	
1J1–B	1J2–B	RX1	0

Multimeter		Range	Resistance (ohms)
+	–		
1J1–C	1J2–C	RX1	0
1J1–C	1J3–C	RX1	0
1J1–D	1J3–D	RX1	0
1J1–E	1J3–E	RX1	0
1J1–F	1J1–*f*	RX100	
1J1–G	1J1–*q*	RX1	
1J1–G	1J1–*r*	RX1	0
1J1–G	1J2–*r*	RX1	0
1J1–G	1J2–*q*	RX1	0
1J1–G	1J1–X	RX1	
1J1–G	1J2–G	RX1	0
1J1–G	1J2–Y	RX1	0
1J1–G	1J2–*t*	RX1	0
1J1–G	1J2–*p*	RX1	0
1J1–G	1J3–AA	RX1	0
1J1–H	1J3–H	RX1	0
1J1–J	1J1–M	RX100	
1J1–J	1J1–BB	RX100	
1J1–K	1J3–K	RX1	0
1J1–L	1J3–L	RX1	0
1J1–M	1J3–M	RX1	0
1J1–M	1J1–J	RX1	
1J1–N	1J2–N	RX1	0
1J1–N	1J3–N	RX1	0
1J1–P	1J1–AA	RX1	0
1J1–P	1J2–P	RX1	0
1J1–R	1J2–R	RX1	0
1J1–R	1J3–R	RX1	0
1J1–S	1J2–S	RX1	0
1J1–S	1J3–S	RX1	0
1J1–T	1J1–G	RX10,000	Infinite
1J1–U	1J1–G	RX10,000	Infinite
1J1–V	1J2–V	RX1	0
1J1–V	1J3–V	RX1	0
1J1–W	1J3–W	RX1	0
1J1–W	1J3–DD	RX10,000	
1J1–X	1J3–X	RX1	0
1J1–X	1J1–G	RX100	
1J1–Y	1J1–G	RX10,000	Infinite
1J1–Z	1J1–G	RX10,000	Infinite
1J1–*a*	1J2–*a*	RX1	0
1J1–*a*	1J3–*a*	RX1	0
1J1–*a*	1J2–*f*	RX1	
1J1–*b*	1J1–G	RX10,000	Infinite
1J1–*b*	1J3–*b*	RX1	0
1J1–*c*	1J1–G	RX10,000	Infinite
1J1–*c*	1J3–*c*	RX1	0
1J1–*d*	1J1–G	RX10,000	Infinite
1J1–*e*	1J3–*e*	RX1	0
1J1–*e*	1J2–*f*	RX100	
1J1–*f*	1J3–*f*	RX1	0
1J1–*f*	1J1–F	RX100	
1J1–*g*	1J1–G	RX10,000	Infinite
1J1–*h*	1J2–*h*	RX1	0
1J1–*h*	1J3–*h*	RX1	0
1J1–*h*	1J2–*f*	RX1	
1J1–*j*	1J3–*i*	RX1	0
1J1–*j*	1J2–*f*	RX1	
1J1–*k*	1J3–*k*	RX1	0
1J1–*k*	1J2–*f*	RX1	
1J1–*m*	1J1–G	RX10,000	Infinite
1J1–*n*	1J1–G	RX10,000	Infinite

Multimeter		Range	Resistance (ohms)
+	–		
1J1–*p*	1J1–G	RX10,000	Infinite
1J1–*r*	1J3–*r*	RX1	0
1J1–*s,t,u, v,w,x.*	1J1–G	RX10,000	Infinite
1J1–BB	1J2–BB	RX1	0
1J1–BB	1J3–BB	RX1	0
1J1–BB	1J1–J	RX1	
1J1–CC	1J2–CC	RX1	0
1J1–CC	1J3–CC	RX1	0
1J1–DD	1J2–DD	RX1	0
1J1–DD	1J3–DD	RX1	0
1J1–EE	1J2–EE	RX1	0
1J1–FF	1J1–G	RX10,000	Infinite
1J1–LL	1J2–*b*	RX1	0
1J1–*y*	1J3–*y*	RX1	0
1J1–*y*	1J2–*f*	RX1	
1J1–*z*	1J3–*z*	RX1	0
1J1–*z*	1J2–*f*	RX1	
1J2–B	1J2–*f*	RX1	0
1J2–B	1J2–*v*	RX1	0
1J2–D	1J2–*c*	RX1	0
1J2–D	1J2–*d*	RX1	0
1J2–D	1J2–*p*	RX1	
1J2–D	1J3–*d*	RX1	0
1J2–D	1J1–G	RX10	
1J2–F	1J3–*t*	RX1	0
1J2–H	1J2–G	RX10,000	Infinite
1J2–J	1J2–*p*	RX1	0
1J2–J	1J2–*s*	RX1	0
1J2–K	1J2–U	RX1	0
1J2–L	1J3–*s*	RX1	0
1J2–M	1J3–*u*	RX1	0
1J2–T	1J2–G	RX10,000	Infinite
1J2–W	1J2–G	RX10,000	Infinite
1J2–X	1J3–*x*	RX1	0
1J2–Z	1J3–Z	RX1	0
1J2–*e*	1J2–*q*	RX1	0
1J2–*e*	1J2–*u*	RX1	0
1J2–*g*	1J2–G	RX10,000	Infinite
1J2–*j*	1J2–G	RX10,000	Infinite
1J2–*k*	1J3–*p*	RX1	0
1J2–*m*	1J3–*m*	RX1	0
1J2–*n*	1J3–*n*	RX1	0
1J2–*n*	1J3–*w*	RX1	0
1J2–*r*	1J2–GG	RX1	0
1J2–*r*	1J2–FF	RX1	0
1J2–*w,x,y,z*	1J2–G	RX10,000	Infinite
1J2–AA	1J2–G	RX10,000	Infinite
1J2–HH	1J2–G	RX10,000	Infinite
1J2–JJ	1J2–G	RX10,000	Infinite
1J2–KK	1J3–HH	RX1	0
1J2–LL	1J3–*v*	RX1	0
1J3–F	1J3–AA	RX10,000	Infinite
1J3–G	1J3–AA	RX10,000	Infinite
1J3–J	1J3–AA	RX10,000	Infinite
1J3–T	1J3–AA	RX10,000	Infinite
1J3–U	1J2–U	RX1	0
1J3–Y	1J3–AA	RX10,000	Infinite
1J3–*b,c,*	1J3–AA	RX10,000	Infinite
1J3–*g*	1J3–AA	RX10,000	Infinite
1J3–*j*	1J3–AA	RX10,000	Infinite
1J3–*q*	1J3–AA	RX10,000	Infinite

Multimeter		Range	Resistance (ohms)
+	-		
1J3-EE, FF	1J3-AA	RX10,000	Infinite
1J3-GG	1J2-*b*	RX10,000	0

3-9. Camera Pulse Panel (Unit 6) Troubleshooting

Direct support troubleshooting procedures for the camera pulse panel are given below.

a. Operational Check.

NOTE

A multimeter is used to make resistance measurements in the following steps.

(1) Using a multimeter on the RS10, 000 ohms range, measure resistance between lug end of wire connected to CAMERA pushbutton switch on camera pulse panel and ground terminal on rear of its front panel (fig. 3-16). Multimeter should indicate infinite.

(2) Using the multimeter on the RX1 ohms range, depress and hold CAMERA pushbutton switch on camera pulse panel. Multimeter should indicate zero ohms.

(3) Release CAMERA pushbutton switch on camera pulse panel then disconnect multimeter.

(4) Fabricate test cable as shown in figure 3-15. Do not connect test cable to +28-volt dc power source.

(5) Set switch S1 on test cable to off (open) position.

(6) Connect test cable between camera pulse panel and the +28 volt dc power source in figure 3-15.

(7) Turn on +28-volt dc power source and set switch S1 on test cable to on (closed) position. Allow 15 minutes for warmup. The camera pulse panel front panel edge lamps should light.

(8) Set switch S1 on test cable to off (open) position.

(9) Turn off +28-volt dc power source and disconnect the test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts referenced in the troubleshooting chart and associated circuits are shown in the schematic diagram (fig. 2-24) and the wiring diagram (fig. 3-16).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Multimeter indicates less than infinite (step 1).	Defective CAMERA pushbutton switch 6S1.	Check switch and replace if defective.
2	Multimeter indicates infinite (step 2).	*a.* Defective CAMERA pushbutton switch 6S1. *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Repair or replace wiring if defective.
3	Front panel edge lamps of camera pulse panel do not light (step 7).	*a.* Defective panel lamps(s) *b.* Defective wiring	*a.* Check lighting panel assembly 134AVP81011-1 and replace if defective. *b.* Repair or replace wiring if defective.

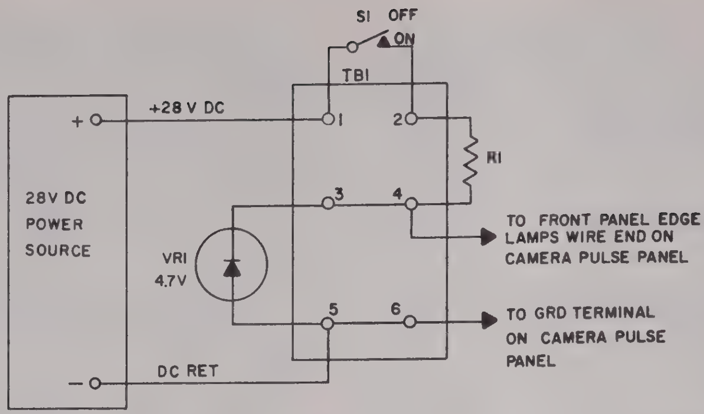
c. Voltage and Resistance V&R Measurements.

(1) *Voltage measurements.* Not applicable.

(2) *Resistance measurements.* The resistance measurements in the following chart are obtained with no power applied to the camera pulse panel and with no external connection to the unit. A multimeter is used to make the following resistance measurements.

Multimeter		Range	Resistance (ohms)
+	-		
Lamp terminal	Ground terminals on rear panel of camera pulse panel.		
Switch terminal	Ground terminal on rear panel of camera pulse panel.	RX10,000	Infinite
Switch terminal	Ground terminal on rear panel of camera pulse panel.	RX1	0[a]

[a]Multimeter indication obtained with CAMERA pushbutton switch on camera pulse panel depressed.



NOTES:

1. USE THE FOLLOWING PARTS:

PART	DESCRIPTION OR MIL STANDARD
SWITCH: S1	MS35058-22
RESISTOR: R1	RW24V100 10 OHMS, ±10% 91W WIRE-WOUND
ZENER DIODE: VR1	IN1600
TERMINAL BOARD: TB1	MIL-T-55164/14 TYPE 8TB6
WIRING	NO.18 AWG

2. USE CONVENIENT LENGTHS OF WIRE AS REQUIRED.

3. PART AND TERMINAL DESIGNATIONS ARE FOR REFERENCE PURPOSES ONLY.

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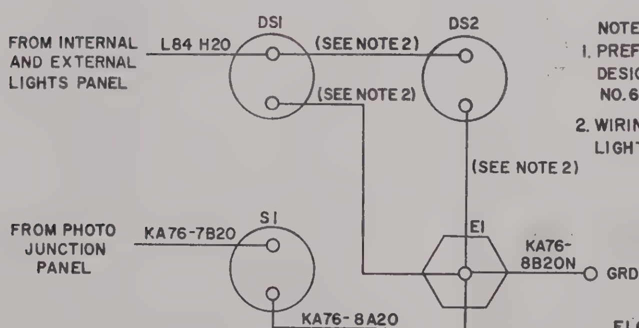
Figure 3-15. Camera pulse panel (134AV81400-1 or 134AV81400-3), cable fabrication diagram and test setup.



NOTES:
1. PREFIX ALL REFERENCE DESIGNATIONS WITH UNIT NO.6
2. WIRING EMBEDDED IN LIGHTING PANEL ASSY.

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Figure 3-16. Camera pulse panel (134AV81400-1 or 134AV81400-3), wiring diagram.

Section III. ADJUSTMENTS, ALIGNMENT, REPAIR REMOVAL, AND REPLACEMENT

WARNING

High voltage is used in this equipment. Be careful when working on the 115-volt ac, 400 Hz, three-phase and +28-volt dc equipment connections. Serious injury or death may result from contact with these terminals.

3-10. General Replacement Techniques

Most parts of the major components can be reached and replaced without special procedures. The general directions given in *a* through *f* below apply.

WARNING

Cleaning compound is flammable and its fumes are toxic. Do not use near a flame; provide adequate ventilation.

a. Clean dirty switch contacts and corroded terminal connections with a clean cloth dampened (not wet) with cleaning compound (Federal stock No. 7930-395-9542).

b. Disassemble a major component only to the extent needed to clean, adjust, repair, or replace the defective part.

c. Before a part is removed, note the position of the part and its leads. Wire the replacement parts in essentially the same position to avoid undesired coupling and shorting together of wires.

d. When removing electrical parts from major components, mark or tag all unsoldered electrical leads for reference purposes.

e. When repair work requires the removal of a dust cover, perform the work in a dust free area.

CAUTION

Do not use a soldering gun; damaging voltages may be induced in circuit components.

f. Certain major components contain transistors and semiconductor diodes. Use an ac-dc pencil-type soldering iron with a 25-watt maximum capacity. If the iron must be used with alternating current, use an isolating transformer between the iron and the line.

3-11. Considerations Before Disassembly

a. Repairs by the direct support maintenance repairman that can be made by disassembly of the particular parts that operate as a group to perform a function are outlined in (1) through (7) below. After removal of the defective major component from the aircraft (TM 11-1510-204-20-1/1), refer to the paragraphs concerning the defective major component. Repair or replace the defective part or parts; then reassemble the major component.

(1) *Manual V/H control panel (Unit 7).* Repairs are made to the manual V/H control panel after removal from the aircraft. Refer to paragraph 3-12 for disassembly and reassembly of the manual V/H control parts shown in figure 3-17.

(2) *Photo junction panel (Unit 8).* Repairs are made to the photo junction panel after removal from the aircraft. Refer to paragraph 3-13 for disassembly and reassembly of the photo junction panel parts shown in figure 3-18.

(3) *Photo control panel (Unit 3).* Repairs are made to the photo control panel after removal from the aircraft. Refer to paragraph 3-14 for disassembly and reassembly of the photo control panel parts shown in figure 3-19.

(4) *Photo system assembly (Unit 1).* Repairs are made to the photo system assembly after removal from the aircraft. Refer to paragraph 3-15 for disassembly and reassembly of the photo system assembly parts shown in figure 3-20.

(5) *Camera pulse panel (134AV81400-1 or 134AV81400-3) (Unit 6).* Repairs are made to the camera pulse panel after removal from the aircraft. Refer to paragraph 3-16 for disassembly and reassembly of the camera pulse panel parts shown in figure 3-21.

(6) *Pod assembly (Unit 10).* Refer to TM 11-6760-228-35-1 for repairs on pod assembly.

(7) *Camera (Unit 9).* Refer to TM 11-6720-236-35 for repairs on camera.

b. Direct support repairs are not performed on the major components listed below.

NOTE

Refer to higher category maintenance for these major components.

(1) Rotary mount actuator (unit 2).

(2) Left, right, and vertical door actuators (Unit 4).

(3) Left, right, and vertical light sensors (Unit 5).

(4) Camera mount A (Unit 11) or camera mount B (Unit 12).

(5) Flight line tracker (Unit 13).

(6) Right oblique sight (Unit 14) and left oblique sight (Unit 15).

3-12. Manual V/H Control Panel (Unit 7), Disassembly and Reassembly

(fig. 3-17)

a. Disassembly. To disassemble the manual V/H control panel, proceed as follows:

(1) Remove 12 screws (1) securing top cover (2) to chassis (42). Remove top cover (2) from chassis (42).

(2) Remove 12 screws (1) securing bottom cover (3) to chassis (42). Remove bottom cover (3) from chassis (42).

(3) Disconnect connector 7P1 (4) from module board assembly 7A1 (5).

(4) Remove module board assembly 7A1 (5) from chassis (42) by pulling it straight down. It is held by friction fit only.

(5) Remove module board assembly 7A5 (6) from chassis (42) by lifting it straight up. It is held by friction fit only.

(6) Remove cap of fuse holder (8).

(7) Remove fuse 7F1 (7) from fuse holder (8).

(8) Unsolder and carefully mark or tag all electrical connections to fuse holder (8).

(9) Remove nut (8) and washer (8) securing fuse holder (8) to chassis (42). Remove fuse holder (8) from chassis (42).

(10) Remove three screws (9) securing panel (10) to panel (41).

(11) Remove panel (10) from panel (41) by pulling connector 7J3 (31).

CAUTION

Use care when separating panel (41) from chassis (42) to prevent damage to interconnecting wires.

(12) Remove five screws (11) securing panel (41) to chassis (42). Carefully move panel (41) away from chassis (42) to allow access to rear of panel.

(13) Unsolder and carefully mark or tag all electrical connections to switch 7S3 (13).

(14) Remove two screws (12) securing switch 7S3 (13) to panel (41). Remove switch 7S3 (13) from panel (41).

(15) To remove two lamps (14) from switch 7S3 (13), rotate legend retainer and extract lamps.

(16) Unsolder and carefully mark or tag all electrical connections to resistor 7R5 (16), capacitor 7C14 (17), and switch 7S4 (18).

(17) Remove nut (18) and key washer (18) securing switch 7S4 (18) to panel (41). Remove switch 7S4 (18) and seal washer (15) from panel (41).

(18) Unsolder and remove resistor 7R5 (16) and capacitor 7C14 (17) from switch 7S4 (18).

(19) Unsolder and carefully mark or tag all electrical connections to resistor 7R3 (19), capacitor 7C12 (17), and switch 7S2 (20).

(20) Remove nut (20) and key washer (20) securing switch 7S2 (20) to panel (41). Remove switch 7S2 (20) and seal washer (15) from panel (41).

(21) Unsolder and remove resistor 7R3 (19) and capacitor 7C12 (17) from switch 7S2 (20).

(22) Unsolder and carefully mark or tag all electrical connections to switch 7S1 (21).

(23) Remove nut (21) and key washer (21) securing switch 7S1 (21) to panel (41). Remove switch 7S1 (21) and seal washer (15) from panel (41).

(24) Unsolder and carefully mark or tag all electrical connections to switch 7S5 (26).

(25) Remove four nuts (22), four washers (23), four washers (24), and four screws (25) securing switch 7S5 (26) to panel (41). Remove switch 7S5 (26) from panel (41).

(26) Remove three lamps (27) from switch 7S5 (26).

(27) Unsolder and carefully mark or tag all electrical connections to switch 7S6 (28).

(28) Remove four nuts (22), four washers (23), four washers (24), and four screws (25) securing switch 7S6 (28) to panel (41). Remove switch 7S6 (28) from panel (41).

(29) Remove five lamps (27) from switch 7S6 (28).

(30) Unsolder and carefully mark or tag all electrical connections to connector 7J3 (31) and associated terminal (29).

(31) Remove nut (31), washer (30), and terminal (29) securing connector 7J3 (31) to panel (41). Remove connector 7J3 (31) from panel (41).

(32) Unsolder and carefully mark or tag all electrical connections to terminal (33).

(33) Remove screw (32) securing terminal (33) to panel (41). Remove terminal (33) from panel (41).

(34) Remove screw (34), washers (35 and 36) and clamp (37).

(35) Remove screw (38) and threaded spacer (39).

(36) Press out four panel fastener stud assemblies (40) from panel (41).

(37) For further disassembly of chassis (42), refer to higher category of maintenance.

b. Reassembly. To reassemble the manual V/H control panel, proceed as follows:

NOTE

Refer to the wiring diagram (fig. 3-3) to obtain correct electrical connections and parts location.

(1) Install four panel fastener stud assemblies (40) on panel (41).

(2) Install threaded spacer (39) to panel (41) using screw (38).

(3) Install clamp (37) to other end of threaded spacer (39) using washer (36), washer (35), and screw (34).

(4) Install terminal (33) on panel (41) using screw (32), then solder appropriate electrical connections to terminal (33).

(5) Install connector 7J3 (31) and associated terminal (29) on panel (41) using washer (30) and nut (31).

(6) Solder appropriate electrical connections to connector 7J3 (31) and terminal (29).

(7) Install five lamps (27) in switch 7S6 (28).

(8) Install switch 7S6 (28) on panel (41) using four screws (25), four washers (24), four washers (23), and four nuts (22).

(9) Solder appropriate electrical connections to switch 7S6 (28) terminals.

(10) Install three lamps (27) in switch 7S5 (26).

(11) Install switch 7S5 (26) on panel (41) using four screws (25), four washers (24), four washers (23), and four nuts (22).

(12) Solder appropriate electrical connections to switch 7S5 (26) terminals.

(13) Install switch 7S1 (21) on panel (41) using seal washer (15), key washer (21), and nut (21).

(14) Solder appropriate electrical connections to switch 7S1 (21) terminals.

(15) Solder resistor 7R3 (19) and capacitor 7C12 (17) to appropriate switch 7S2 (20) terminals.

(16) Install switch 7S2 (20) on panel (41) using seal washer (15), key washer (20), and nut (20).

(17) Solder appropriate electrical connections to switch 7S2 (20) terminals, resistor 7R3 (19), and capacitor 7C12 (17).

(18) Solder resistor 7R5 (16) and capacitor 7C14 (17) to appropriate switch 7S4 (18) terminals.

(19) Install switch 7S4 (18) on panel (41) using seal washer (15), key washer (18), and nut (18).

(20) Solder appropriate electrical connections to switch 7S4 (18) terminals, resistor 7R5 (16), and capacitor 7C14 (17).

(21) Install two lamps (14) in switch 7S3 (13).

(22) Install switch 7S3 (13) on panel (41) using two screws (12).

(23) Solder appropriate electrical connections to switch 7S3 (13).

(24) Install panel (41) on chassis (42) using five screws (11).

(25) Align panel (10) against panel (41) so that connector 7P3 (part of panel (10)) mates with connector 7J3 (31).

(26) Secure panel (10) to panel (41) using three screws (9).

(27) Install fuse holder (8) on chassis (42) using washer (8) and nut (8).

(28) Solder appropriate electrical connections to fuse holder (8) terminals.

(29) Install fuse (7) in fuse holder (8), then secure fuse in place with cap (8).

(30) Install module board assembly 7A5 (6) in chassis (42).

(31) Install module board assembly 7A1 (5) in chassis (42) by sliding up through bottom of chassis (42).

(32) Connect connector 7P1 (4) to module board assembly 7A1 (5).

(33) Install bottom cover (3) to chassis (42) using 12 screws (1).

(34) Install top cover (2) to chassis (42) using 12 screws (1).

3-13. Photo Junction Panel (Unit 8), Disassembly and Reassembly
(fig. 3-18)

a. Disassembly. To disassemble the photo junction panel, proceed as follows:

(1) Release the four Dzus fasteners (5) to free the cover (7). The cover (7) cannot be separated completely from the panel (65) until the cover chain is removed.

(2) Remove nuts (1), two washers (2) and two screws (3) to release the chain (4) from the cover (7) and panel (65).

(3) Remove four fasteners (5) and grommets (6) from cover (7).

(4) Unsolder and carefully mark or tag all electrical connections to the terminals on the bottom of relay 8K1 (14) and relays 8K2 through 8K4 (15).

(5) To release the cover (11) from relay 8K1 (14), remove four screws (8), four washers (9), and four nuts (10).

(6) To release relay 8K1 (14) from the panel (65), remove four screws (12) and four washers (13). Remove the relay 8K1 (14) by lifting it off the panel (65) ledge.

(7) To release relay 8K2, or 8K4 (15) from the panel (65), remove the four nuts (16), four washers (17), and four lockwashers (18) provided with each relay. Remove each relay 8K2, 8K3 or 8K4 (15) by lifting it straight up until its mounting studs clear the panel (65) ledge.

(8) Remove 16 nuts (19) from terminal board 8TB82 (27).

(9) Remove terminal connecting link (20) from terminal board 8TB82 (27).

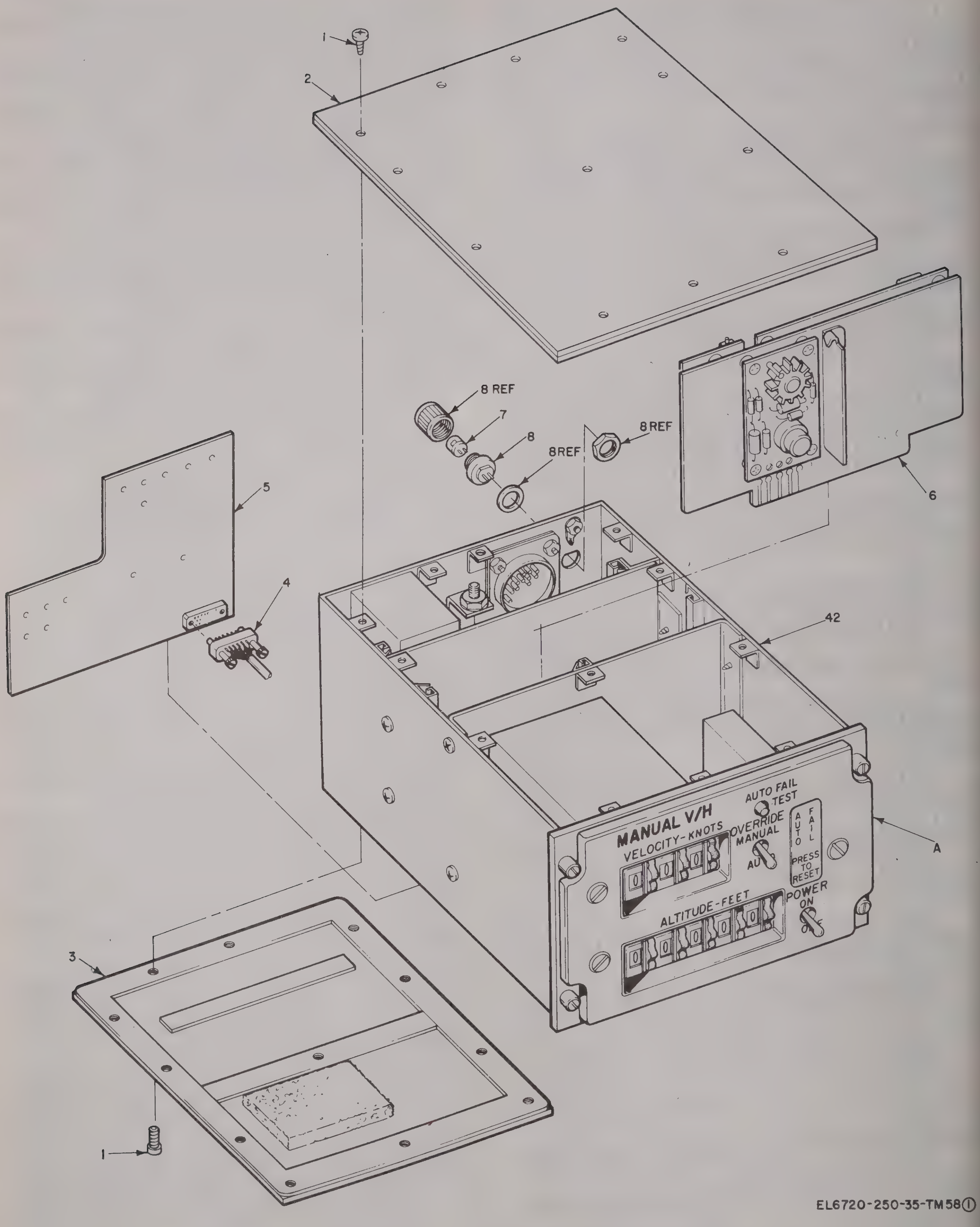

Figure 3-17(1). Manual V/H control panel, exploded view (sheet 1 of 2).

Note. Prefix all reference designations for the manual V/H control panel with 7.

1 Screw (24)
2 Cover, top (1)
3 Cover, bottom (1)
4 Connector (P1) (1)
5 Board assembly (A1) (1)
6 Board assembly (A5) (1)
7 Fuse (F1 and spare) (2)
8 Fuse holder (XF1 and spare) (2) (nut and washer supplied with fuse holder)
9 Screw (3)
10 Panel (1)
11 Screw (5)
12 Screw (2)
13 Switch (S3) (1)
14 Lamp (2) (P/o item 13)
15 Seal washer (3)
16 Resistor (R5) (1)
17 Capacitor (C12 and C14) (2)
18 Switch (S4) (1) (nut and key washer supplied with switch)
19 Resistor (R3) (1)
20 Switch (S2) (1) (nut and key washer supplied with switch)
21 Switch (S1) (1) (nut and key washer supplied with switch)
22 Nut (8)
23 Washer (8)
24 Washer (8)
25 Screw (8)
26 Switch (S5)
27 Lamp (8)
28 Switch (S6)
29 Terminal (1)
30 Washer (1)
31 Connector (J3) (1) (nut supplied with connector)
32 Screw (1)
33 Terminal (2)
34 Screw (1)
35 Washer (1)
36 Washer (1)
37 Clamp (1)
38 Screw (2)
39 Threaded spacer (1)
40 Stud assembly (4)
41 Panel (1)
42 Chassis (1)

Figure 3-17(2)—Continued.

(10) Remove capacitor 8C1 (21) and clamp 22) from terminal board 8TB82 (27).

(11) To gain access to terminal board ounting screw (26) remove four washers (23), vo insulators (24) and insulator (25).

(12) To release terminal board 8TB82 (27) id identification strip (28), remove three screws 6).

(13) To release mounting plate (29), remove ree screws (30). The three spacers (31) will en fall free.

(14) Remove 16 nuts (32) from terminal ard 8TB83 (38).

(15) Remove two terminal connecting links 3) from terminal board 8TB83 (38).

(16) To gain access to terminal board mount- g screws (37) remove four washers (34), two sulators (35) and one insulator (36).

(17) To release terminal board 8TB83 (38) d identification strip (39), remove three screws 7).

(18) Remove 16 nuts (32) from terminal ard 8TB84 (40).

(19) Remove four terminal connecting links 3) from terminal board 8TB84 (40).

(20) To gain access to terminal board mount- g screws (37) remove four washers (34), two sulators (35) and one insulator (36).

(21) To release terminal board 8TB84 (40) d identification strip (41), remove three screws 7).

(22) To release mounting plate (42), remove three screws (43). The three spacers (44) will then fall free.

(23) The removal of terminal boards 8TB85 and 8TB86 (45 and 46) and their identification strips (47 and 48) are the same as terminal boards 8TB83 and 8TB84 (38 and 40) except for the quantity and type of terminal connecting links. Terminal board 8TB85 (45) has no terminal connecting links but does have diode 8CR1 (49). Terminal board 8TB86 (46) has terminal connecting links (50 and 51).

(24) To release nut plates (52 or 53) from the panel (65), punch out associated rivets (54).

(25) To release panel fastener receptacle (55), punch out associated rivets (56).

(26) To completely clear panel (65) of remaining hardware, remove grommet (57), grommet (58), two self-locking nuts (59), two terminals (60), two nuts (61), two washers (62), two lockwashers (63), and two screws (64).

b. Reassembly. To reassemble the photo junction panel, proceed as follows:

NOTE

Refer to the wiring diagram (fig. 3-5 to obtain correct electrical connections and parts location.

(1) Assemble two screws (64), two lockwashers (63), two washers (62), and two nuts (61) to panel (65).

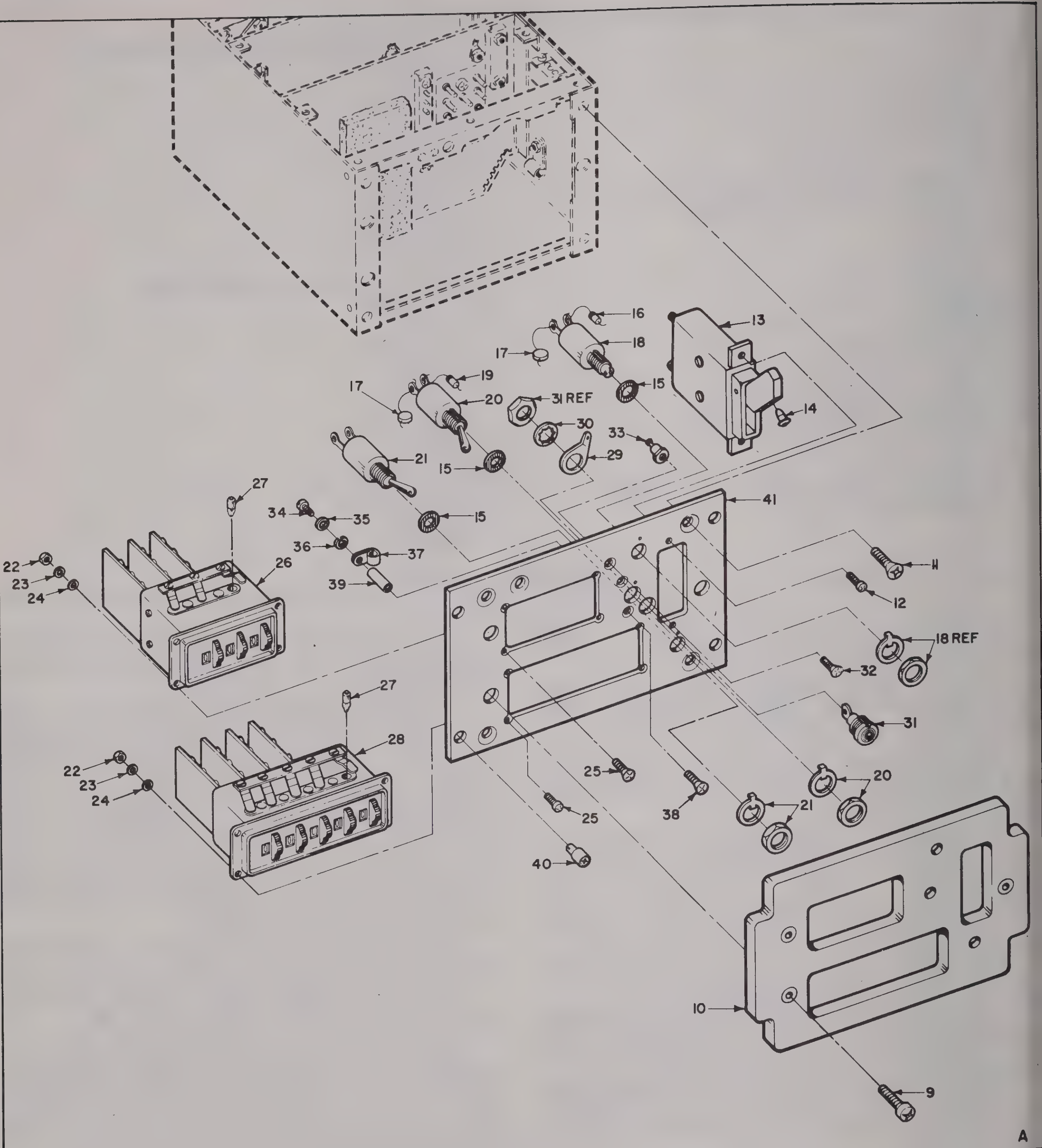

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Figure 3-17(2). Manual V/H control panel, exploded view (sheet 2 of 2).

(2) Place one terminal (60) on each screw (64) and secure using self-locking nut (59).

(3) Install four receptacles (55) in place on panel (65) using eight rivets (56). Two rivets (56) are required for each receptacle (55).

(4) Install nine nut plates (52) on pan (65) using rivets (54). Two rivets (54) are r quired for each nut plate (52).

(5) Install four nut plates (53) on the u derside of the panel (65) top ledge using rive

54). Two rivets (54) are required for each nut late (53).

(6) Install two grommets (58 and 57).

(7) To install mounting plates (42), place hree spacers (44) behind mounting plate (42) nd secure to panel (65) using three screws 43).

(8) Place terminal board 8TB83 (38) on dentification strip (39) and secure to mounting late (42) using three screws (37).

(9) Place terminal board 8TB84 (40) on dentification strip (41) and secure mounting late (42) using three screws (37).

(10) Place terminal board 8TB85 (45) on dentification strip (47) and secure to mounting late (42) using three screws (37).

(11) Place terminal board 8TB86 (46) on dentification strip (48) and secure to mounting late (42) using three screws (37).

(12) Place one insulator (36) on terminals 8 nd 9 of terminal board 8TB86 (46). Place one nsulator (36) on terminals 8 and 9 of the other erminal boards 8TB85, 8TB84 and 8TB83 (45, 0, and 38).

(13) Place insulator (35) on terminals 1 and 6 of terminal boards 8TB83 through 8TB86 (38, 0, 45, and 46). Orientate insulator (35) so tab f insulator covers the head of screw (37) adjaent to it.

(14) Place one washer (34) on terminals 1, , 9, and 16 of terminal boards 8TB83 through TB86 (38, 40, 45, and 46).

(15) Place two terminal connecting links 33) on terminal board 8TB83 (38). Two are reuired. Install one link (33) on terminals 9 and 0, and the other on terminals 15 and 16.

(16) Install 16 nuts (32) (one on each terinal) to terminal board 8TB83 (38).

(17) Place terminal connecting links (33) on erminal board 8TB84 (40). Four are required. nstall first link (33) on terminals 4 and 5, the econd link (33) on terminals 10 and 11, the hird link on terminals 12 and 13, and the fourth nk (33) on terminals 14 and 15.

(18) Install 16 nuts (32) (one on each terinal) to terminal board 8TB84 (40).

(19) Solder diode (49) to terminals 11 and 3 of terminal board 8TB85 (45). Cathode end diode to be connected at terminal 11.

(20) Install 16 nuts (32) (one on each terinal) to terminal board 8TB85 (45).

(21) Place terminal connecting link (51) on erminals 13, 14, 15, and 16 of terminal board TB86 (46).

(22) Place terminal connecting link (50) on terminals 3 and 4 of terminal board 8TB86 (46).

(23) Install 16 nuts (32) (one on each terminal) to terminal board 8TB86 (46).

(24) To install mounting plate (29), place three spacers (31), behind mounting plate (29), and secure using three screws (30).

(25) Place terminal board 8TB82 (27) on identification strip (28), and secure to mounting place (29), using three screws (26).

(26) Place insulator (25) on terminals 8 and 9 of terminal board 8TB82 (27).

(27) Place two insulators (24) on terminals 1 and 16 of terminal board 8TB82 (27).

(28) Place four washers (23) on terminals 1, 8, 9, and 16 of terminal board 8TB82 (27).

(29) Place terminal connecting link (20) on terminals 9 and 10 of terminal board 8TB82 (27).

(30) Place capacitor 8C1 (21) in clamp (22) and install clamp (22) on terminal 15 of terminal board 8TB82 (27). Connect positive lead of capacitor 8C1 (21) to terminal 14 and negative lead to terminal 16 of terminal board 8TB82 (27).

(31) Attach sixteen nuts (19) (one of each terminal) to terminal board 8TB82 (27).

(32) Install relays 8K2 through 8K4 (15) and secure using four lockwashers (18), four washers (17) and four nuts (16) provided with each relay.

(33) Install relay 8K1 (14) and secure using four washers (13) and four screws (12).

(34) Position cover (11) on relay 8K1 (14) and secure using four screws (8), four washers (9), and four nuts (10).

(35) Install grommet (6) and fastener (5) on cover (7).

(36) Install chain (4) to cover (7) and panel (65) using two screws (3), two washers (2), and two nuts (1).

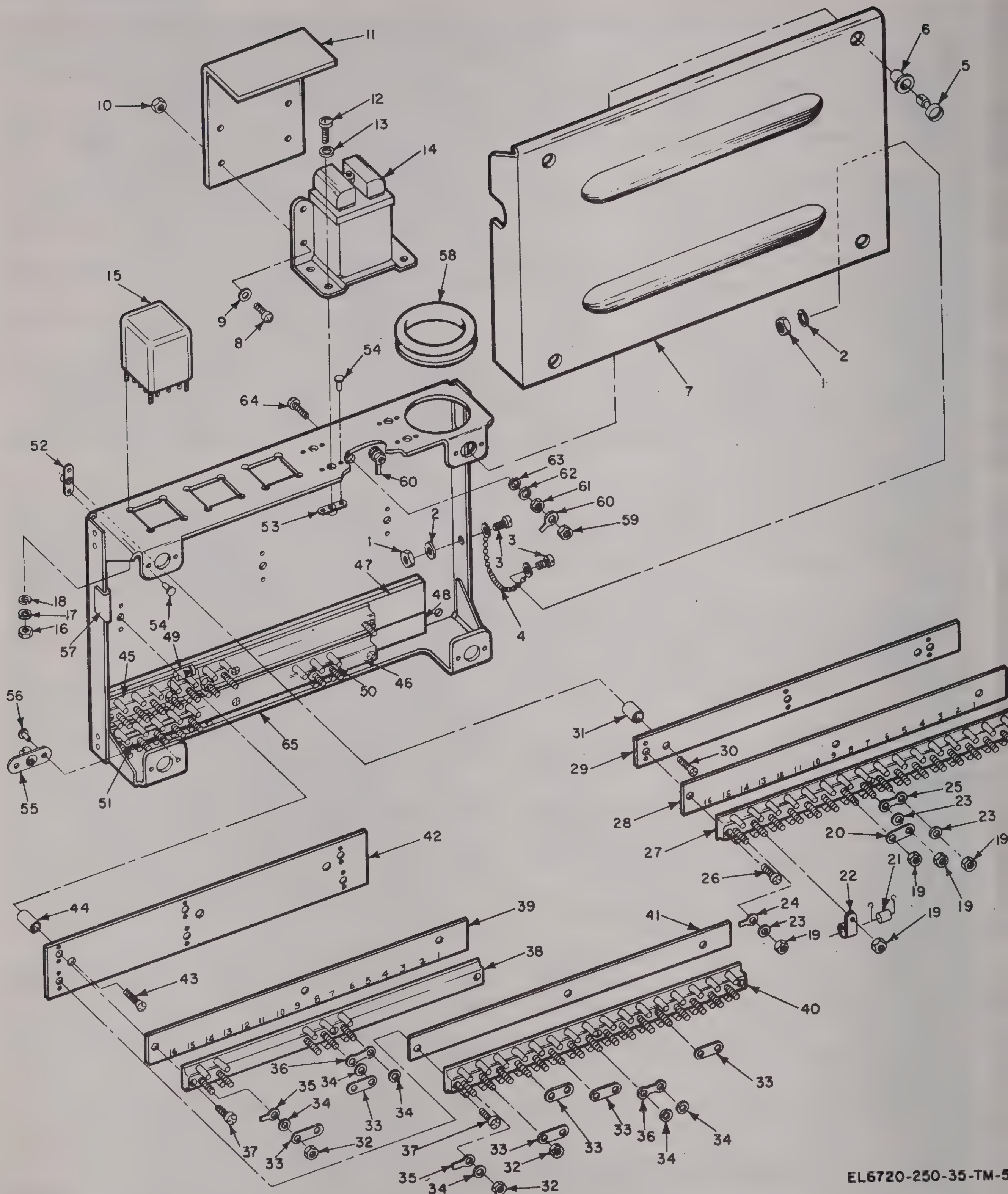
(37) Position cover (7) on panel (65) and secure with Dzus fasteners (5).

3–14. Photo Control Panel (Unit 3), Disassembly and Reassembly
(fig. 3–19)

a. Disassembly. To disassemble the photo control panel, proceed as follows:

(1) To remove the cover (1), loosen two captive fasteners located on back of cover, and slide cover toward rear mounting plate (8).

(2) Loosen two setscrews (2) in knobs (2), then remove the knobs.



Note. Prefix all reference designations for the photo junction panel with 8.

1 Nut (2)
2 Washer (2)
3 Screw (2)
4 Chain (1)
5 Fastener (4)
6 Grommet (4)
7 Cover (1)
8 Screw (4)

Figure 3-18. Photo junction panel, exploded view.

9 Washer (4)
10 Nut (4)
11 Cover (1)
12 Screw (4)
13 Washer (4)
14 Relay (K1) (1)
15 Relay (K2 through K4) (3)
16 Nut (12) (P/o item 15)
17 Washer (12) (P/o item 15)
18 Lockwasher (12) (P/o item 15)
19 Nut (16)
20 Link (1)
21 Capacitor (C1) (1)
22 Clamp (1)
23 Washer (4)
24 Insulator (2)
25 Insulator (1)
26 Screw (3)
27 Terminal board (TB82) (1)
28 Identification strip (1)
29 Mounting plate (1)
30 Screw (3)
31 Spacer (3)
32 Nut (64)
33 Link (56)
34 Washer (16)
35 Insulator (8)
36 Insulator (4)
37 Screw (12)
38 Terminal board (TB83) (1)
39 Identification strip (1)
40 Terminal board (TB84) (1)
41 Identification strip (1)
42 Mounting plate (2)
43 Screw (6)
44 Spacer (6)
45 Terminal board TB85 (1)
46 Terminal board TB86 (1)
47 Identification strip (1)
48 Identification strip (1)
49 Semiconductor device, diode (CR1) (1)
50 Link (1)
51 Link (1)
52 Nut plate (9)
53 Nut plate (4)
54 Rivet (26)
55 Receptacle (4)
56 Rivet (8)
57 Grommet (1)
58 Grommet (1)
59 Nut, self-locking (2)
60 Terminal (2)
61 Nut (2)
62 Washer (2)
63 Lockwasher (2)
64 Screw (2)
65 Panel (1)

Figure 3-18—Continued.

(3) Remove indicator caps XDS1 and XDS2 (10 and 11) by rotating them counterclockwise, then remove associated lamps DS1 and DS2 (3).

(4) Removing four screws (4), separate front panel A1 (5) from panel mounting plate (26).

NOTE

Before disconnecting any wire leads, secure a tag to each lead to identify its terminal location.

(5) To provide access to rear of components mounted on panel mounting plate (26) release rear mounting plate (8) by removing four screws (6) and two screws (7).

(6) To remove switch 3S1 (9), unsolder and disconnect leads from switch and remove the attaching nut (9), lockwasher (9), and key washer (9).

(7) To remove indicator 3XDS1 (10), unsolder and disconnect leads from indicator and remove the attaching nut (10) and lockwasher (10).

(8) To remove indicator 3XDS2 (11), unsolder and disconnect leads from indicator and remove the attaching nut (11) and lockwasher (11).

(9) To remove switch 3S3 (12), unsolder and disconnect leads from switch and remove the attaching nut (12), lockwasher (12), and key washer (12).

(10) To remove switch 3S4 (13), unsolder and disconnect leads from switch and remove the attaching nut (13), lockwasher (13), and key washer (13).

(11) To remove switch 3S2 (14), unsolder and disconnect leads from switch and remove the attaching nut (14), lockwasher (14), and key washer (14).

(12) To remove counter 3M1 (15) from panel mounting plate (26), unsolder and disconnect leads from counter and remove two screws (16).

(13) Remove nut (17) securing bracket (18) to counter 3M1 (15). Remove bracket (18), washer (19), and washer (20).

(14) To remove connector 3J2 (21), unsolder and disconnect leads from connector and remove nut (21) and lockwasher (21).

(15) To remove filter 3FL1 (22) from bracket and component assembly (25), unsolder and disconnect leads from filter and remove nut (22).

(16) Unsolder and disconnect coil 3L1 (23), and two diodes 3CR1 and 3CR2 (24) from bracket and component assembly (25).

b. Reassembly. To reassemble the photo control panel, proceed as follows:

NOTE

Refer to the wiring diagram (fig. 3-8) to obtain correct electrical connections and parts location.

(1) Solder two diodes 3CR1 and 3CR2 (24) and coil 3L1 (23) to bracket and component assembly (25).

(2) Install connector 3J2 (21) on panel mounting plate (26) and secure using lockwasher (21) and nut (21).

(3) Install filter 3FL1 (22) on bracket and component assembly (25) and secure using nut (19).

(4) Assemble washer (20), washer (19), and bracket (18) on counter 3M1 (15) and secure using nut (17).

(5) Guide knurled shaft of counter 3M1 (15) through hole in panel mounting plate (26) and secure counter 3M1 (15) using two screws (16).

(6) Install switch 3S2 (14) and panel mounting plate (26) and secure using key washer (14), lockwasher (14), and nut (14).

(7) Install switch 3S4 (13) on panel mount ing plate (26) and secure using key washer (13), lockwasher (13), and nut (13).

(8) Install switch 3S3 (12) on panel mounting plate (26) and secure using key washer (12), lockwasher (12), and nut (12).

(9) Install light indicators 3XDS2 (11) on panel mounting plate (26) and secure using lockwasher (11) and nut (11).

(10) Install light indicator 3XDS1 (10) on panel mounting plate (26) and secure using lockwasher (10) and nut (10).

(11) Install switch 3S1 (9) and secure using key washer (9), lockwasher (9), and nut (9).

(12) Solder all wires to their respective components and secure wires with cable ties or harness string.

(13) Position rear mounting plate (8) and secure using two screws (7) and four screws (6).

(14) Align front panel 3A1 (5) with panel mounting plate (26) and secure using four screws (4).

(15) Install lamps DS1 and DS2 (3) and indicator caps (10 and 11) on light indicators 3XDS1 (10) and 3XDS2 (11).

(16) Install two knobs (2) on switch 3S3 (12) and switch 3S2 (14), and secure using setscrews (2).

(17) Install cover (1) over chassis and lock in place with the two captive fasteners provided on the cover.

3-15. Photo System Assembly (Unit 1), Disassembly and Reassembly

(fig. 3-20)

a. Disassembly. To disassemble the photo system assembly, proceed as follows:

NOTE

The tray and shock mount assembly (items 1 through 7) need not be disassembled in conjunction with the photo system assembly. Similarly, the tray and shock mount assembly can be repaired without disassembling the photo system assembly, unless a situation exists that requires disassembly of both units.

(1) To remove a shock mount (2), remov screw (1) and detach the ground strap (3).

(2) To remove block (5), remove tw screws (4). Then, using a center punch, pus out pin (6) from block (if removal i necessary).

(3) If the tray and shock mount assembly i to be disassembled in conjunction with the phot system asembly, proceed with the followin procedure; otherwise, reassembly the tray an shock mount assembly by reversing the proce dures in (1) and (2) above.

(4) Loosen the captive fasteners on back o cover (8) and remove the cover by sliding i backward and off the unit.

(5) To remove intervalometer module 1A (9), film drive amplifier module 1A2 (10), an the PC board and component assembly modul 1A3 (11), hold the component firmly with fin ger tips and carefully lift straight up to disen gage component from connector.

NOTE

Before disconnecting any wire leads, note or tag each lead to identify its terminal location.

(6) To remove RF filter 1FL5 (12), un solder leads from filter and remove nut (12) an washer (12).

(7) Remove bracket (13) by removing tw nuts (14) and two screws (15).

(8) Remove bracket and guide assemb (16), remove eight screws (17), eight nuts (18

ınd terminal (19) to provide access to remaining omponents on chassis (69).

(9) Unsolder and remove capacitor 1C1 (20) and seven diodes 1CR3, 1CR5, 1CR6, CR8 through 1CR11 (21).

(10) To remove relays 1K3, 1K5 and 1K6 22), unsolder leads and remove two screws 23) and two nuts (24) from each relay.

(11) To remove relays 1K4 and 1K7 (25), nsolder leads and remove four screws (26) and our nuts (27) for each relay.

(12) Unsolder and remove two diodes 1CR4 nd 1CR7 (28) from relays 1K4 and 1K7 (25).

(13) To remove RF filter 1FL2 (29), unolder leads and remove two screws (30) and wo nuts (31).

(14) To remove RF filters 1FL6 and 1FL7 32), unsolder leads and remove nut (32) and asher (32).

(15) To remove each bracket (33), remove vo screws (34).

(16) To remove fuse holders 1XF1 through XF6 (35) and spares (35), unscrew fuse holder ıp (35) and remove fuses 1F1 through 1F6 36) and three spares (36). Unsolder leads from ıse holder (35) and remove nut (35), lockasher (35), and washer (35).

(17) To remove HOURS indicator meter M1 (37), unsolder leads and remove two nuts 38), two washers (39), and two screws (40).

(18) To remove connector cap (41), remove rew (42) and nut (43).

(19) To remove handles (44), remove two rews (45) and two washers (46) from each ındle (44).

(20) Remove two screws (47), screw (48) d nut (49) to provide access to components on gle mounting bracket (68).

(21) To remove RF filter 1FL4 (50), unlder leads and remove two screws (51) and o nuts (52).

(22) To remove RF filter 1FL1 (53), unlder leads and remove two screws (54), termil (55), and two nuts (56).

(23) To remove RF filter 1FL3 (57), unlder leads and remove two screws (58) and o nuts (59).

(24) To remove relay 1K2 (60), unsolder ıds and remove two screws (61) and two nuts 2).

(25) Unsolder and remove diode 1CR2 (63) om relay 1K2 (60).

(26) To remove relay 1K1 (64), unsolder ıds and remove two screws (65) and two nuts 6).

(27) Unsolder and remove diode 1CR1 (67).

b. Reassembly. To reassemble the photo system assembly, proceed as follows:

NOTE

Refer to wiring diagram (fig. 3-14) to obtain correct electrical connections.

(1) Solder diode 1CR1 (67) to standoff terminal on angle mounting bracket (68). Cathode end of diode (67) to be toward bottom of angle mounting bracket (68).

(2) Install relay 1K1 (64) using two nuts (66) and two screws (65).

(3) Solder diode 1CR2 (63) between unnumbered terminal with colored lead and terminal No. 13 of relay 1K2 (60). Cathode end of diode (63) shall be attached to unnumbered terminal with colored lead.

(4) Install relay 1K2 (60) using two nuts (62) and two screws (61).

(5) Install RF filter 1FL3 (57) with terminal 2 facing relay 1K2 (60) and secure using two nuts (59) and two screws (58).

(6) Install RF filter 1FL1 (53) with terminal L facing relay 1K2 (60) and secure using two nuts (56), termnal (55), and two screws (54).

(7) Install RF filter 1FL4 (50) with terminals L facing relay 1K2 (60) and secure using two nuts (52) and two screws (51).

(8) Solder appropriate electrical connections to terminals on relays 1K1 and 1K2, and RF filters 1FL1, 1FL3 and 1FL4.

(9) Secure angle mounting bracket (68) to chassis (69) using nut (49), screw (48), and two screws (47).

(10) Install each handle (44) using two washers (46) and two screws (45).

(11) Install connector cap (41) and secure using nut (43) and screw (42).

(12) Install HOURS indicator meter 1M1 (37) and secure using two screws (40), two washers (39), and two nuts (38).

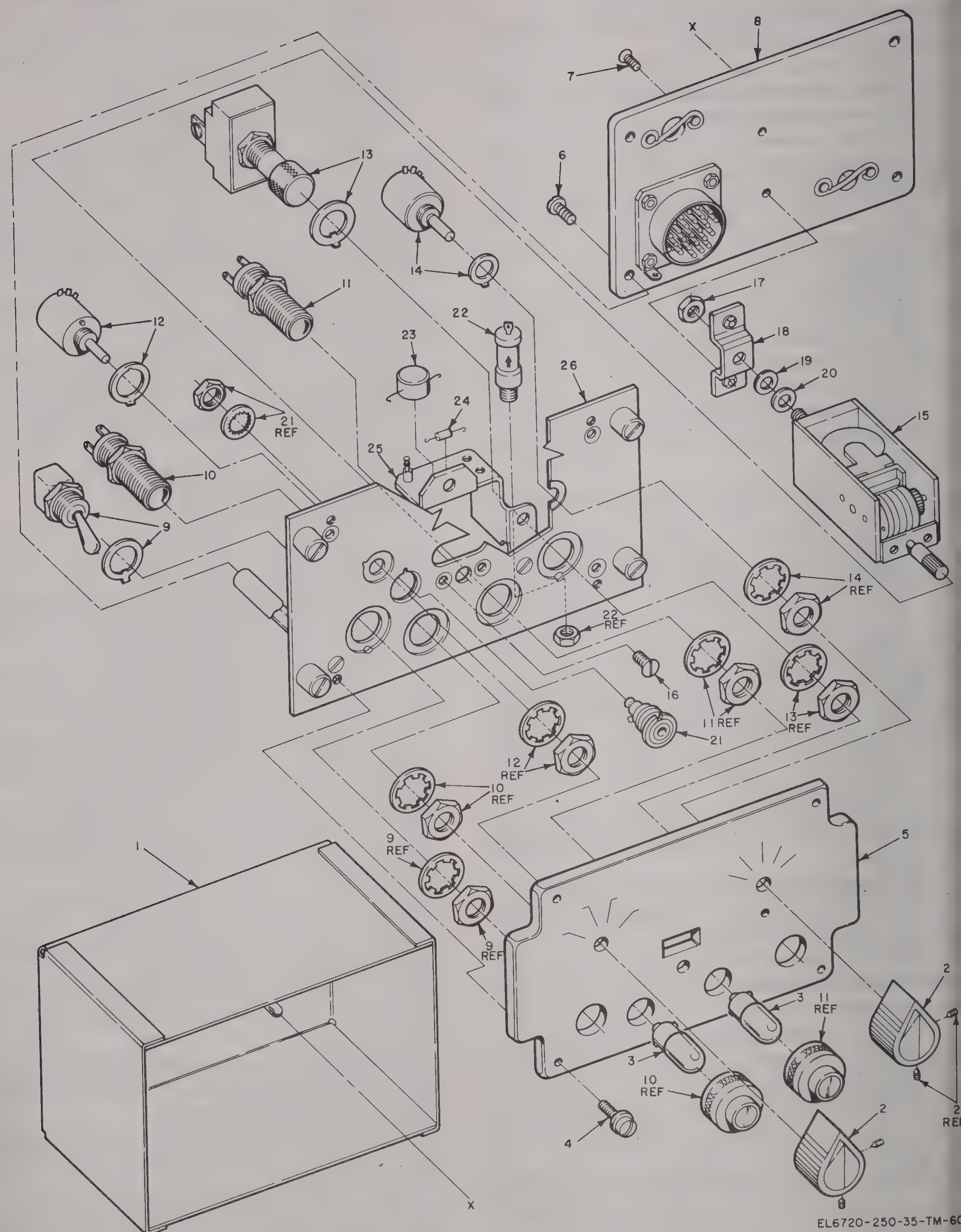
(13) Install washer (35) (provided with fuse holder) on fuse holder 1XF1 through 1XF6 (35) and three spares (35).

(14) Install fuse holders 1XF1 through 1XF6 (35) and three spares (35) and secure using lockwasher (35) and nut (35).

(15) Install fuses 1F1 through 1F6 and three spares (36) in their respective fuse holders and secure using fuse cap (35).

(16) Install bracket (33) using two screws (34).

(17) Install RF filters 1FL6 and 1FL7 (32) and secure using washer (32) and nut (32).



Note. Prefix all reference designations for the photo control panel with 3.

1 Cover (1)
2 Knob (2) (setscrews supplied with knobs)
3 Lamp (DS1, DS2) (2)
4 Screw (4)

Figure 3-19. Photo control panel, exploded view.

Panel, front (A1) (1)
Screw (4)
Screw (2)
Plate, rear mounting (1)
Switch (S1) (1) (nut, washer and key washer supplied with switch)
Indicator, light (XDS1) (1) (nut and washer supplied with indicator)
Indicator, light (XDS2) (1) (nut and washer supplied with indicator)
Switch (S3) (1) (nut, washer, and key washer supplied with switch)
Switch (S4) (1) (nut, washer and key washer supplied with switch)
Switch (S2) (1) (nut, washer and key washer supplied with switch)

15 Counter (M1) (1)
16 Screw (2)
17 Nut (1)
18 Bracket (1)
19 Washer (1)
20 Washer (1)
21 Connector (J2) (1) (nut and washer supplied with connector)
22 Filter (FL2) (1) (nut supplied with filter)
23 Coil (L1) (1)
24 Semiconductor device, diode (CR1, CR2) (2)
25 Bracket and component assembly (1)
26 Plate, panel mounting (1)

Figure 3-19—Continued.

(18) Install RF filter 1FL2 (29) with termi- l L toward front panel and secure using two ts (31) and two screws (30).

(19) Solder diode 1CR4 and 1CR7 (28) to lays 1K4 and 1K7 (25) respectively. Diodes e installed between terminals 1 and 7 with the hode of diode connected to terminal 7.

(20) Install relays 1K4 and 1K7 (25) and ure using four nuts (27) and four screws (26) each relay.

(21) Install relays 1K3, 1K5 and 1K6 (22) d secure using two nuts (24) and two screws 3), for each relay.

(22) Solder seven diodes 1CR3, 1CR5, 1CR6, R8 through 1CR11 (21) and capacitor 1C1)) in place. Refer to figure 3-14 for orienta- n of cathodes on diodes (21) and polarity of pacitor 1C1 (20).

(23) Install bracket and guide assembly (16) l secure using eight nuts (18), terminal (19), l eight screws (17).

(24) Install bracket (13) and secure using screws (15) and two nuts (14).

(25) Install RF filter 1FL5 (12) and secure ng washer (12) and nut (12).

(26) Solder appropriate electrical connec- ns to terminals on HOURS indicator meter 1; fuse holders 1XF1 through 1XF6; RF fil- s 1FL2, and 1FL5 through 1FL7; and relays through 1K7. Secure wire handles with le ties or harness string.

(27) Install PC board and component assem- module 1A3 (11), film drive amplifier mod- 1A2 (10), and Intervalometer module 1A1 into their corresponding connectors. Be sure module mates properly and firmly into its nector.

(28) Install cover (8) on chassis (69) and ure using captive fasteners located on rear of r (8).

(29) If the tray (7) was disassembled in conjunction with the photo system assembly, press pin (6) into block (5).

(30) Install block (5) and secure using two screws (4).

(31) Place ground strap (3) between tray (7) and shock mount (2) and secure shock mount (2) using screw (1).

(32) Install the photo system assembly on tray and lock in place with the knurled clamps of the tray.

3-16. Camera Pulse Panel (Unit 6) Disassembly and Reassembly
(fig. 3-21)

a. Disassembly. To disassemble the camera pulse panel, proceed as follows:

(1) Remove the two screws (1) securing panel (4) to plate (10).

(2) Carefully separate panel (4) from plate (10) by disconnecting male connector (2) from female connector (5).

(3) Remove screw (5) and washer (5) securing wire lug to female connector (5). Mark or tag removed wire.

(4) Remove nut (5) and lockwasher (5) securing female connector (5) to plate (10). Remove female connector (5) from plate (10).

(5) Remove and carefully mark or tag electrical connections to switch 6S1 (6).

(6) Remove nut (6) and lockwsaher (6) securing switch 6S1 (6) to plate (10). Remove switch 6S1 (6) from plate (10).

(7) Remove end nut (7) on terminal (7) that secures terminal wiring. Remove and mark or tag terminal wiring.

(8) Remove remaining nut (7), flat washer (7), and lockwasher (7) securing terminal (7) to plate (10). Remove terminal (7) from plate (10).

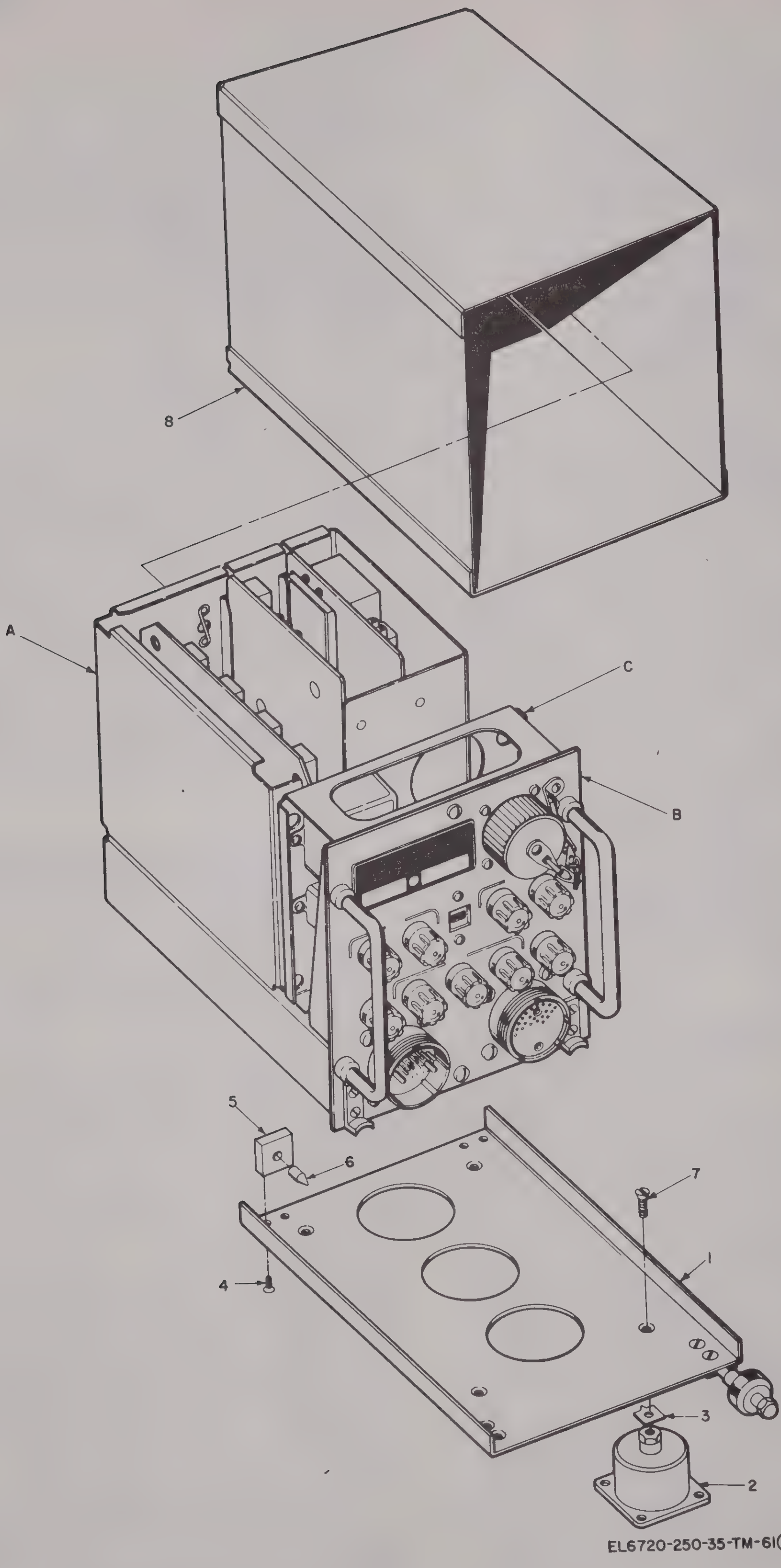


Figure 3-20(1). Photo system assembly, exploded view (sheet 1 of 4).

Vote. Prefix all reference designations for the photo system assembly with 1.

Screw (4)
Mount, shock (4)
Strap, ground (2)
Screw (4)
Block (2)
Pin (2)
Tray (1)
Cover (1)
Intervalometer module (A1)
Film drive amplifier module (A2)
PC board and component assembly module (A3)
Filter, RF (1FL5) (1) (nut and washer supplied with filter)
Bracket (1)
Nut (2)
Screw (2)
Bracket and guide assembly (1)
Screw (8)
Nut (8)
Terminal (1)
Capacitor (C1) (1)
Semiconductor device, diode (CR3, CR5, CR6, CR8 through CR11) (7)
Relay (K3, K5 and K6) (3)
Screw (6)
Nut (6)
Relay (K4, K7) (2)
Screw (8)
Nut (8)
Semiconductor device, diode (CR4, CR7) (2)
Filter, RF (FL2) (1)
Screw (2)
Nut (2)
Filter, RF (FL6, FL7) (2) (nut and washer supplied with filter)
Bracket (2)
Screw (4)

35 Fuse holders (XF1 through XF6) (9) (nut and washers supplied with fuse holder)
36 Fuse (F1 through F6, 3 spares) (9)
37 Meter, HOURS indicator (M1) (1)
38 Nut (2)
39 Washer (2)
40 Screw (2)
41 Cap, connector (1)
42 Screw (1)
43 Nut (1)
44 Handle (2)
45 Screw (4)
46 Washer (4)
47 Screw (2)
48 Screw (1)
49 Nut (1)
50 Filter, RF (FL4) (1)
51 Screw (2)
52 Nut (2)
53 Filter RF (FL1) (1)
54 Screw (2)
55 Terminal (1)
56 Nut (2)
57 Filter, RF (FL3) (1)
58 Screw (2)
59 Nut (2)
60 Relay (K2) (1)
61 Screw (2)
62 Nut (2)
63 Semiconductor device, diode (CR2) (1)
64 Relay (K1) (1)
65 Screw (2)
66 Nut (2)
67 Semiconductor device, diode (CR1) (1)
68 Bracket, angle mounting (1)
69 Chassis (1)

Figure 3-20(1)—Continued.

(9) Remove two grommets (3) from panel and two nut plates (9) from plate (10).

Reassembly. To reassemble the camera e panel, proceed as follows:

NOTE

Be sure all wires are connected to their respective terminals in accordance with the wiring diagram (fig. 3-16).

(1) Install two nut plates (9) to plate (10) g two rivets (8) for each nut plate.

(2) Install terminal (7) to plate (10) using lockwasher (7), flat washer (7), and nut

(3) Connect appropriate wires to terminal and secure with remaining nut (7).

(4) Install switch 6S1 (6) to plate (10) using a lockwasher (6) and nut (6).

(5) Solder appropriate electrical connections to switch 6S1 (6) terminals.

(6) Install female connector (5) to plate (10) using lockwasher (5) and nut (5).

(7) Connect wire lug to female connector (5) using washer (5) and screw (5).

(8) Install two grommets (3) to panel (4).

(9) Place panel (4) against plate (10) so that male connector (2) mates with female connector (5).

(10) Secure panel (4) to plate (10) using two screws (1).

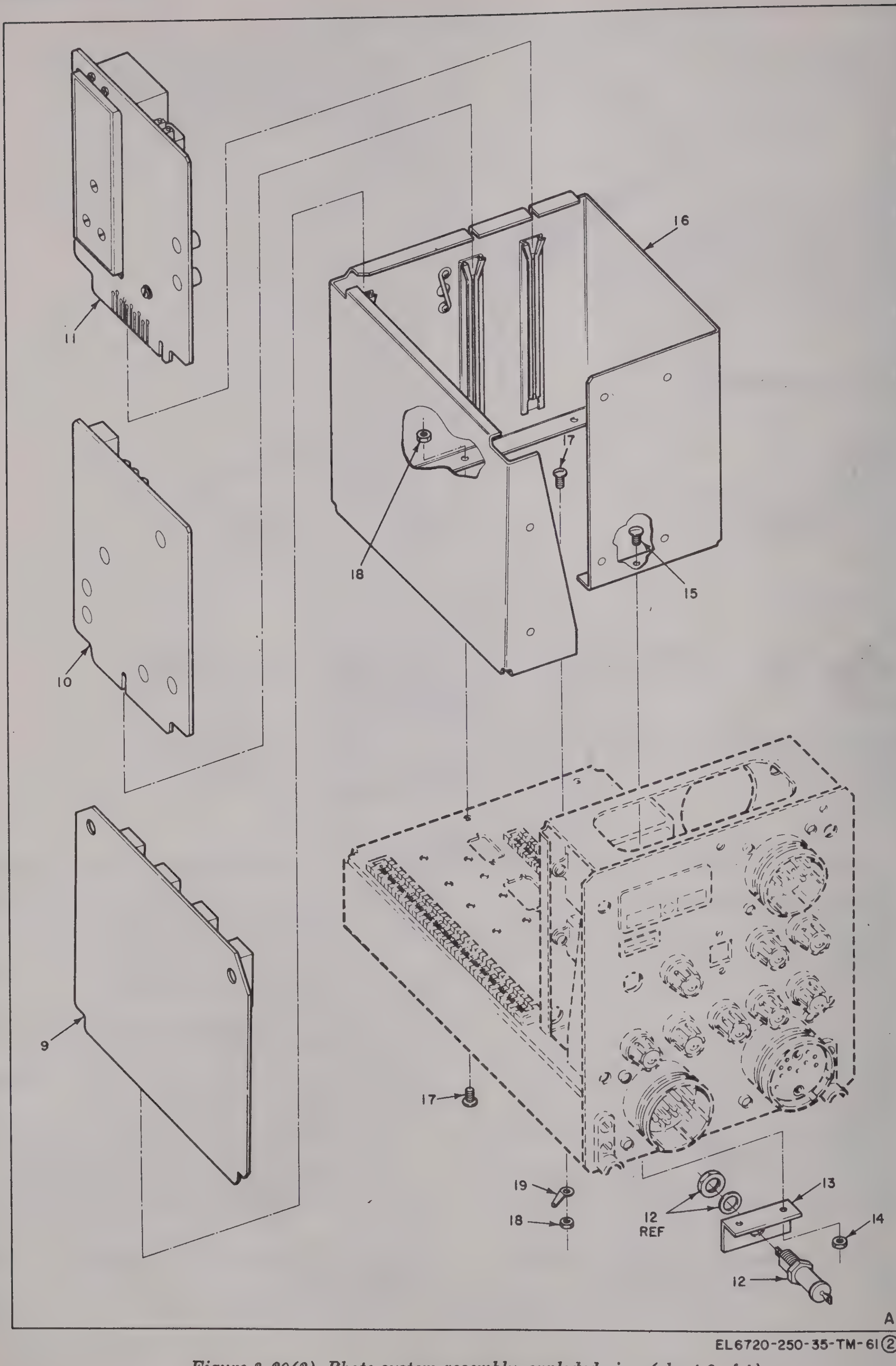


Figure 3-20(2). Photo system assembly, exploded view (sheet 2 of 4).

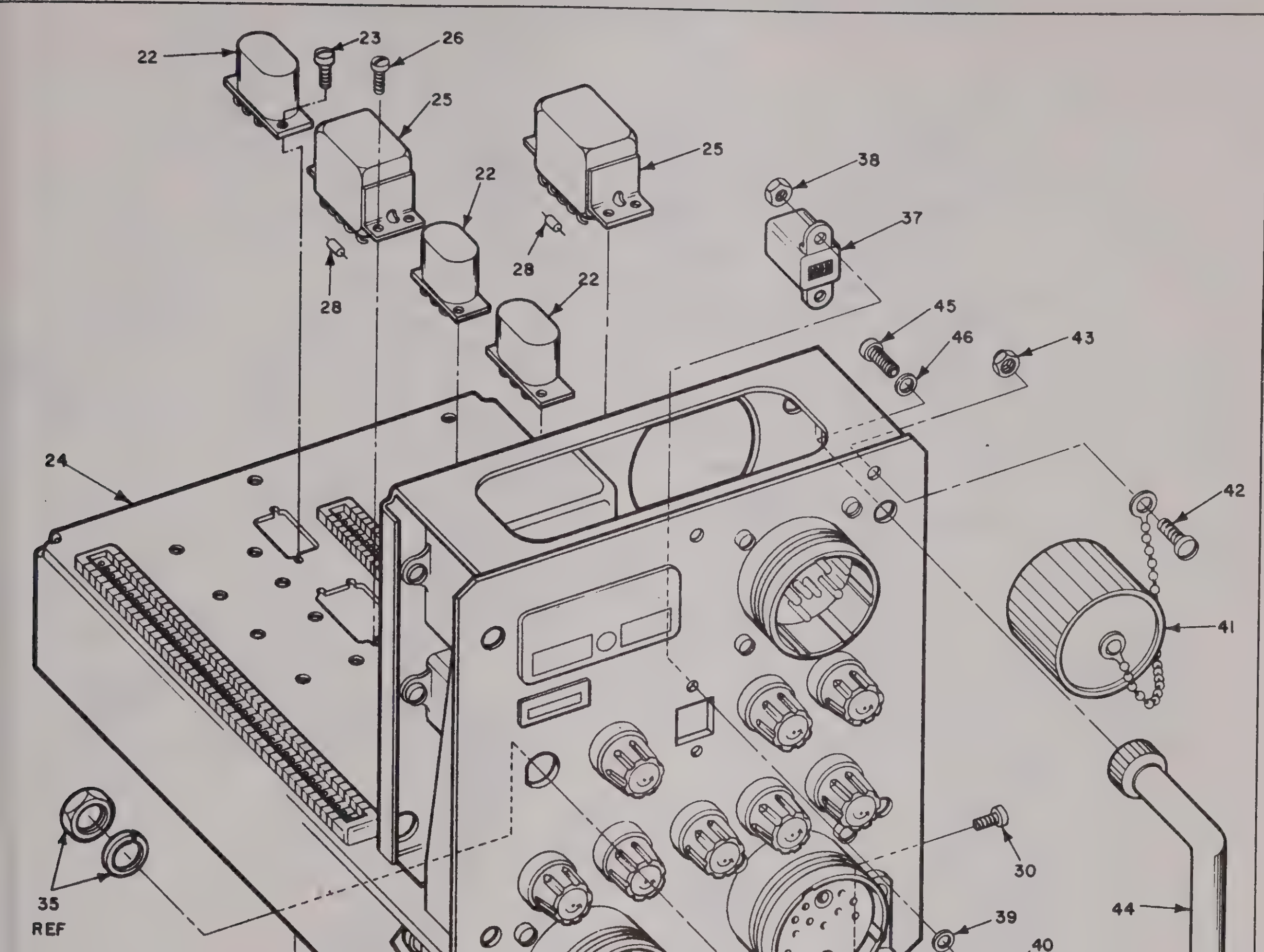


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Figure 3-20(3). Photo system assembly, exploded view (sheet 3 of 4).

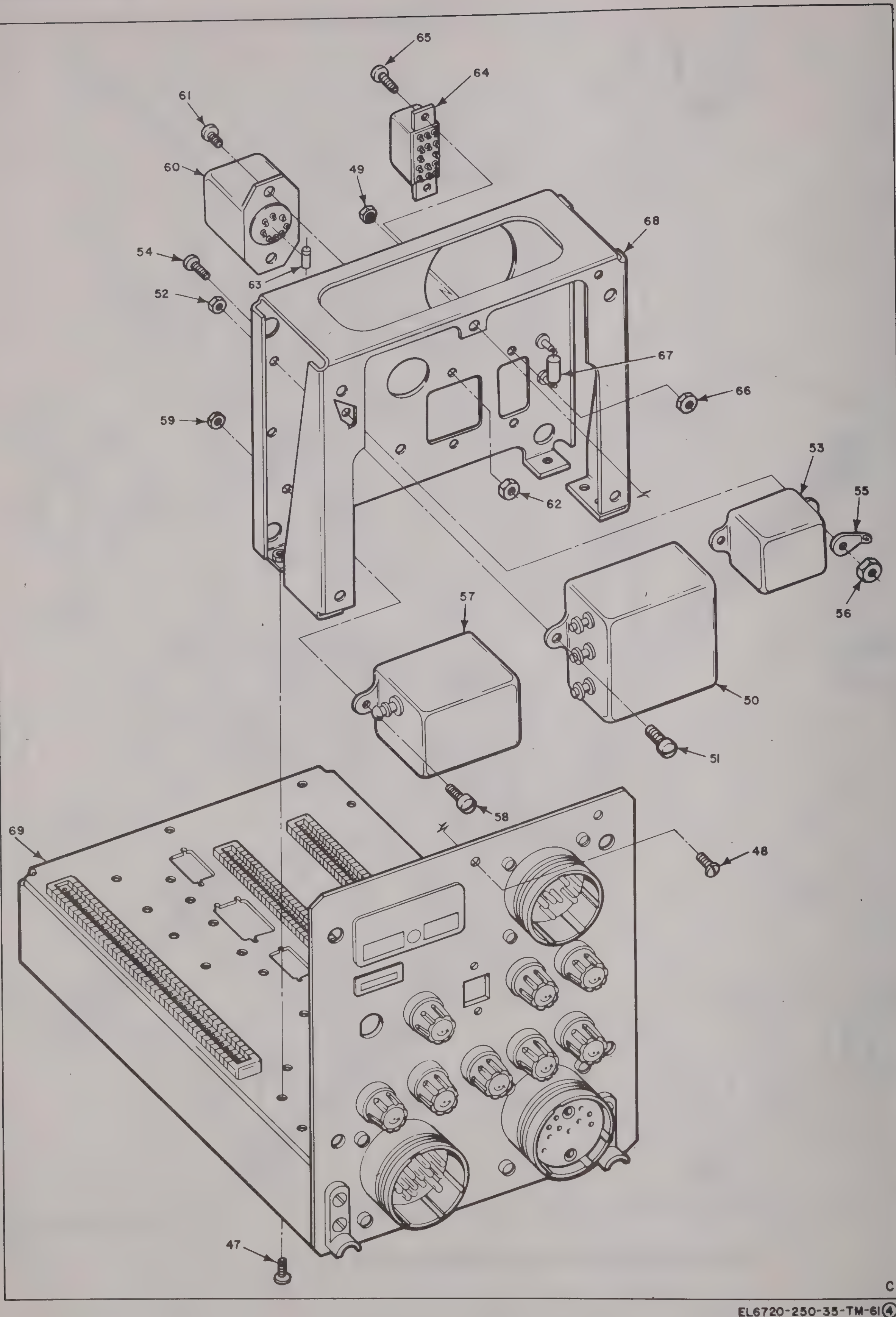

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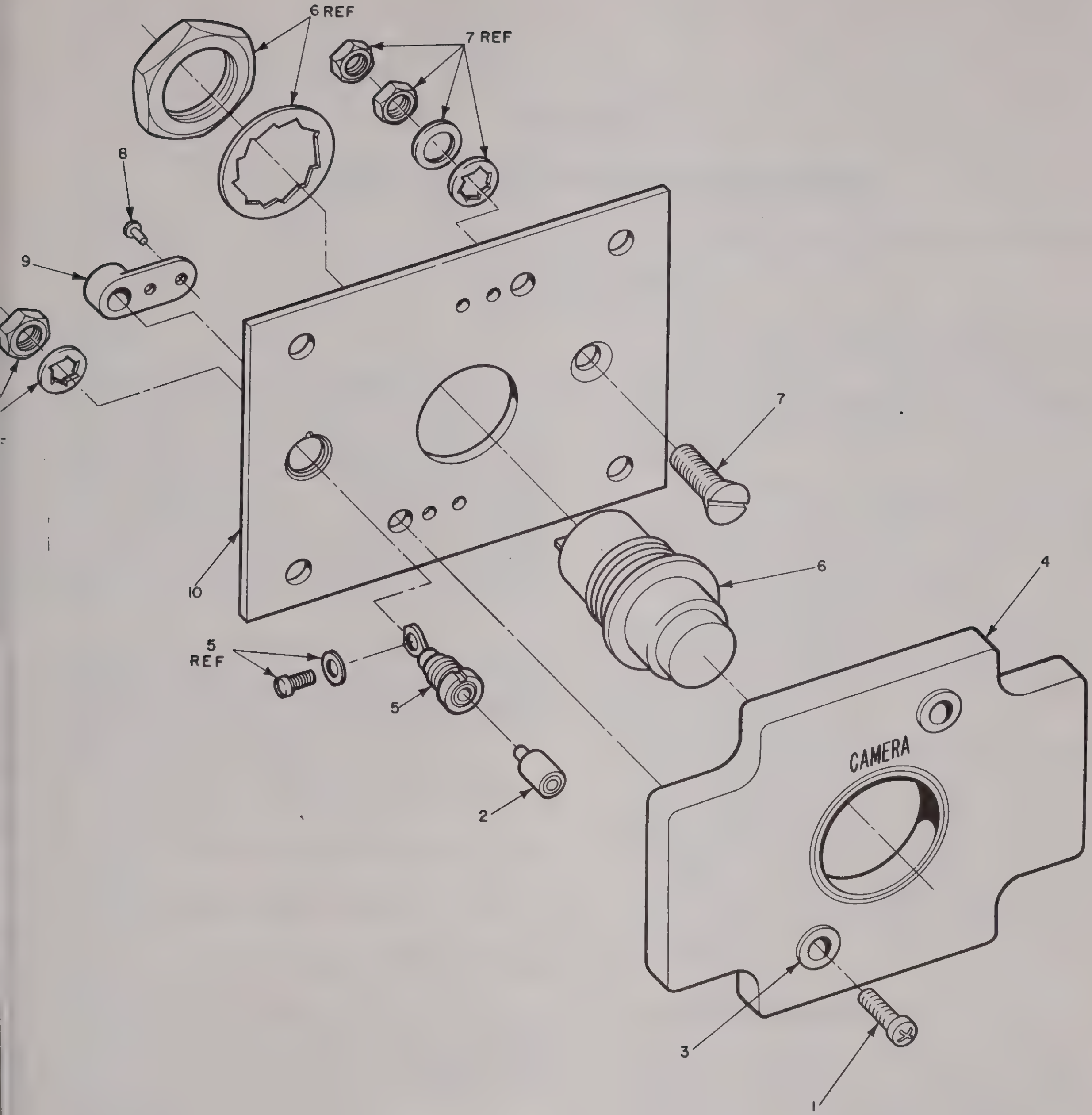
Figure 3-20(4). Photo system assembly, exploded view (sheet 4 of 4).



te. Prefix all reference designations for the camera pulse panel with 6.

crew (2)
onnector, male (1)
rommet (2)
anel (1)
onnector, female (1) (hardware supplied with connector)
6 Switch (S1) (1) (nuts and lockwasher supplied with switch)
7 Terminal (1) (hardware supplied with terminal)
8 Rivet (4)
9 Nut plate (2)
10 Plate (1)

Figure 3-21. Camera pulse panel, exploded view.

CHAPTER 4

DIRECT SUPPORT TESTING PROCEDURES

Section I. GENERAL

4-1. General

a. Testing procedures are prepared for use by Signal field maintenance shops and Signal service organizations responsible for direct support maintenance of electronic equipment to determine the acceptability of repaired electronic equipment. These procedures set forth specific requirements that repaired electronic equipment must meet before it is returned to the using organization.

b. The testing procedures for major components within the capabilities of the direct support maintenance repairman are listed below, together with references to their respective paragraphs or applicable technical manuals.

(1) Manual V/H control panel (Unit 7) (paras 4-4 and 4-5).

(2) Photo junction panel (Unit 8) (paras 4-6 and 4-7).

(3) Photo control panel (Unit 3) (paras 4-8 and 4-9).

(4) Photo system assembly (Unit 1) (paras 4-10 and 4-11).

(5) Rotary mount actuator (Unit 2). Testing procedures are not within the capabilities of the direct support maintenance repairman, refer to higher category of maintenance.

(6) Door actuator (Unit 4). Testing procedures are not within the capabilities of the direct support maintenance repairman, refer to higher category of maintenance.

(7) Light sensor (Unit 5). Testing procedures are not within the capabilities of the direct support maintenance repairman, refer to higher category of maintenance.

(8) Camera pulse panel (134AV81400-1 or 134AV81400-3) (Unit 6) (paras 4-12 and 4-13).

(9) Pod assembly (Unit 10). Refer to TM 11-6760-228-35-1 for testing procedures on pod assembly.

(10) Camera (Unit 9). Refer to TM 11-6720-236-35 for testing procedures on camera.

(11) Camera mount A (Unit 11) or camera mount B (Unit 12). Testing procedures are not within the capabilities of the direct support maintenance repairman, refer to higher category of maintenance.

(12) Flight line tracker (Unit 13). Testing procedures are not within the capabilities of the direct support maintenance repairman; refer to higher category of maintenance.

(13) Right oblique sight (Unit 14) and left oblique sight (Unit 15). Testing procedures are not within the capabilities of the direct support maintenance repairman, refer to higher category of maintenance.

c. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each step of each test procedure in sequence. For each step, perform all the actions required in the *Test equipment* and *Equipment under test* columns; then perform each specific test procedure and verify it against its performance standard.

4-2. Special Requirements

Test cables must be fabricated to permit operation of equipment in accordance with the test procedures contained in this chapter. Ac and dc power sources also must be supplied. The wiring details and listing of parts needed to fabricate these test cables are included in drawings for the following listed equipment. Power source requirements also form a part of these drawings.

a. Manual V/H Control Panel (Unit 7). Figure 3-1 shows the test cable fabrication details and test setup which are necessary to permit operational testing of the manual V/H control panel.

b. Photo Junction Panel (Unit 8). Figure 3-4 shows the test lead fabrication details and test setup which are necessary to permit operational testing of the photo junction panel.

c. Photo Control Panel (Unit 3). Figure 3-6 shows the test cable fabrication details and test

setup which are necessary to permit operational testing of the photo control panel.

d. Photo System Assembly (Unit 1). Figure 3-9 shows the test cables fabrication details and test setup which are necessary to permit operational testing of the photo system assembly.

e. Camera Pulse Panel (134AV81400-1 or 134AV81400-3) (Unit 6). Figure 3-15 shows the test lead fabrication details and test setup which are necessary to permit operational testing of the camera pulse panel.

4-3. Modification Work Orders

Not applicable.

Section II. MANUAL V/H CONTROL PANEL (UNIT 7)

4-4. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Tool Kit TK-77/GF.

(2) Vacuum cleaner (Federal stock number 7910-215-5786).

(3) Cleaning compound (Federal stock number 7930-395-9542).

(4) Lint free cloth (Federal stock number 8305-170-5062).

(5) Ethyl alcohol (grade II, class B, Federal Specification O-E-760).

(6) Camel's hairbrush (Federal stock number 8020-245-4509).

b. Test Connections and Conditions.

(1) Disconnect and remove manual V/H control panel from the installation in aircraft as directed in TM 11-1510-204-20-2/1.

(2) Disassemble the manual V/H control panel to the degree necessary for accomplishing physical tests and inspection (para 3-12).

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	NA	MANUAL V/H CONTROL PANEL: Controls may be in any position.	*a.* Inspect all controls and mechanical assemblies for loose or missing screws, washers, and nuts.	*a.* Screws, washers, and nuts must be tight; no missing parts.
			b. Inspect all connectors and receptacles, including the fuse holder for looseness and damage.	*b.* No evidence of looseness or damage.
			c. Inspect chassis for missing screws, fittings and nuts. Inspect the condition of the finish and panel lettering.	*c.* Screws, fittings, and nuts must be tight; no missing parts. External surfaces must be painted and panel lettering must be legible.
			Note. **Touchup painting is recommended in lieu of refinishing whenever practicable. Screw heads, binding posts, receptacles, and plated fastener parts will not be painted or polished with abrasives.**	
			d. Inspect all numerals on VELOCITY-KNOTS and ALTITUDE-FEET thumbwheel switches.	*d.* Numerals must be clear and legible.
2	NA	MANUAL V/H CONTROL PANEL: Controls may be in any position.	*a.* Set POWER switch to ON and OFF positions.	*a.* Switch should operate freely in both positions.
			b. Set OVERRIDE switch to MANUAL and AUTO positions.	*b.* Switch should operate freely in both positions.
			c. Depress PRESS TO RESET switch and then release.	*c.* Switch should depress and release freely.
			d. Depress AUTO FAIL TEST switch and then release.	*d.* Switch should depress and release freely.
			e. Rotate the three VELOCITY-KNOTS thumbwheel switches through all positions.	*e.* Thumbwheel switches should index properly and rotate freely.
			f. Rotate the five ALTITUDE-FEET thumbwheel switches through all positions.	*f.* Thumbwheel switches should index properly and rotate freely between indexed positions.

4-5. Electrical Test

a. Test Equipment and Materials.

(1) Switch MS25103-24.
(2) Switch MS35058-22 (3 required).
(3) Terminal board MS27212-1-20.
(4) Connector MS3126F-14-19S.
(5) Resistor RW24V100.
(6) Zener diode 1N1600.
(7) Wiring, No. 18 AWG (as required).
(8) Connector MS3126F-14-19S.
(9) Multimeter TS-352 B/U.
(10) Power source, 108 to 118 volts ac, single phase, 400 Hz.
(11) Power source, +24 to +28.5 volts dc.
(12) Tool Kit TK-77/GF.

b. Test Connections and Conditions.

WARNING

Make sure that 115-volts ac, 400-Hz, and +28-volt dc power sources are off before performing steps (1) through (4), below. Dangerous voltages of 115 volts ac, 400 Hz, and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate test cable as shown in figure 3-1.

(2) On manual V/H control panel, set switches as follows:

(*a*) POWER switch to OFF position.

(*b*) OVERRIDE switch to MANUAL position.

(*c*) VELOCITY - KNOTS thumbwheel switches to 200.

(*d*) ALTITUDE - FEET thumbwheel switches to 00100.

(3) On test cable, set switches S1, S2, S3, and S4 to open positions.

(4) Connect ac and dc power sources to test cable as shown in figure 3-1. Connect P1 of test cable to connector 7J1 on manual V/H control panel.

(5) Turn on ac and dc power sources.

c. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	TEST CABLE: Switch S1: On (closed position). *Note.* Allow 15 minutes for warmup.	NA	Observe the two front panel edge lamps, three VELOCITY-KNOTS lamps, and the five ALTITUDE-FEET lamps on the manual V/H control panel.	All lamps should light.
2	NA	MANUAL V/H CONTROL PANEL: POWER switch: ON	*a.* Observe AUTO FAIL indicator on manual V/H control panel. *b.* Momentarily depress PUSH TO RESET switch on manual V/H control panel.	*a.* AUTO FAIL indicator should flash at approximate rate of one flash-per-second. *b.* AUTO FAIL indicator should stop flashing and remain constantly lit.
3	TEST CABLE: Switch S4: On (closed position).	NA	Observe AUTO FAIL indicator on manual V/H control panel.	AUTO FAIL indicator should go out.
4	TEST CABLE: Switch S2: On (closed position).	NA	*a.* Observe AUTO FAIL indicator on manual V/H control panel. *b.* Momentarily depress PRESS TO RESET switch on manual V/H control panel.	*a.* AUTO FAIL indicator should flash at approximate rate of one flash-per-second. *b.* AUTO FAIL indicator should stop flashing and remain constantly lit.
5	TEST CABLE: Switch S3: On (closed position).	NA	Observe AUTO FAIL indicator on manual V/H control panel.	AUTO FAIL indicator should remain lit but with reduced brightness.
6	TEST CABLE: Switches S2 and S3: Off (open position).	NA	Observe AUTO FAIL indicator on manual V/H control panel.	AUTO FAIL indicator should go out.
7	NA	MANUAL V/H CONTROL PANEL: AUTO FAIL TEST switch: depress and hold.	*a.* Observe AUTO FAIL indicator on manual V/H control panel. *b.* Release AUTO FAIL TEST switch on manual V/H control panel.	*a.* AUTO FAIL indicator should flash at approximate rate of one flash-per-second. *b.* AUTO FAIL indicator should go out.
8	MULTIMETER: Set to 50 vdc range.	NA	Using multimeter, measure voltage between terminals TB1–P (–) and TB1–M (+) on test cable terminal board.	Multimeter should indicate 0 volt dc.
9	MULTIMETER: Set to 50 vdc range.	MANUAL V/H CONTROL PANEL: OVERRIDE switch: AUTO	Using multimeter, measure voltage between terminals TB1–P (–) and TB1–M (+) on test cable terminal board. *Note.* The following voltage checks are made to determine if the manual E V/H circuitry is operational and not to determine if the circuitry is properly adjusted.	Multimeter should indicate from +26.5 to +29.5 volts dc.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
10	MULTIMETER: Set to 250 vdc range.	NA	Using multimeter, measure voltage between terminal TB1–D (–) and TB1–E (+) on test cable terminal board.	Multimeter should indicate from +98 to +102 volts dc.
11	MULTIMETER: Set to 250 vdc range.	MANUAL V/H CONTROL PANEL: VELOCITY-KNOTS thumbwheel switches: 050 ALTITUDE-FEET thumbwheel switches: 00050	Using multimeter, measure voltage between terminals TB1–D (–) and TB1–E (+) on test cable terminal board.	Multimeter should indicate from +48 to +52 volts dc.
12	MULTIMETER: Set to 2.5 vdc range.	MANUAL V/H CONTROL PANEL: VELOCITY-KNOTS thumbwheel switches: 450 ALTITUDE-FEET thumbwheel switches: 49990.	Using multimeter, measure voltage between terminals TB1–D (–) and TB1–E (+) on test cable terminal board.	Multimeter should indicate from +0.4 to +0.6 volt dc.
13	TEST CABLE: Switches S1 through S4: Off (open position).	MANUAL V/H CONTROL PANEL: POWER switch: OFF	Observe front panel edge lamps, VELOCITY-KNOTS lamps, and ALTITUDE-FEET lamps on the manual V/H control panel.	All lamps should go out.
14	POWER SOURCES: Power switches: Off.	----------	Disconnect test setup.	

Section III. PHOTO JUNCTION PANEL (UNIT 8)

4-6. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Tool Kit TK-77/GF.

(2) Vacuum cleaner (Federal stock number 7910-215-5786).

(3) Cleaning compound (Federal stock number 7930-395-9542).

(4) Lint free cloth (Federal stock number 8305-170-5062).

(5) Ethyl alcohol (grade II, class B, Federal Specification O-E-760).

(6) Camel's hairbrush (Federal stock number 8020-245-4509).

b. Test Connections and Conditions.

(1) Disconnect and remove photo junction panel from aircraft as directed in TM 11-1510-204-20-2/1.

(2) Disassemble the photo junction panel to the degree necessary for accomplishing physical tests and inspection (para 3-13).

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	NA	NA	Inspect all assemblies for loose or missing hardware.	All hardware items must be secured properly; no missing parts.
2	NA	NA	Inspect all relays and terminal boards, diode, and capacitor.	No evidence of looseness or damage.
3	NA	NA	Inspect all surfaces for scratches, nicks, dents, and panel lettering.	No damage sufficient to impair functioning of unit; lettering must be legible.

4-7. Electrical Test

a. Test Equipment and Materials.

(1) Multimeter TS-352 B/U.

(2) Tool Kit TK-77/GF.

(3) Electrical clips, type TCI per Federal Specification W-C-440 (2 required).

(4) Wiring, No. 16 AWG (as required).

(5) Power source, +24 to 28.5 volts dc.

b. Test Connections and Conditions.

(1) Fabricate a test cable as shown in figure 3-4. Do not make connections to dc power source.

(2) Remove the front cover of the photo junction panel as directed in paragraph 3-21 for access to its internal circuits.

(3) Connect test cable (fig. 3-4) to +28-volt dc power source.

c. Initial Test Equipment Calibration. Check zero indication on multimeter for accuracy.

d. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	MULTIMETER: Set to RX1 ohms range.	NA	Check contacts A2 and A3 on relay 8K1 on photo junction panel for continuity.	Multimeter should indicate less than 0.5 ohm.
2	MULTIMETER: Set to RX1 ohms range.	NA	Check for following contacts on relay 8K2 on photo junction panel for continuity: A2 and A3 B2 and B3 C2 and C3 D2 and D3	Multimeter should indicate less than 0.5 ohm for each set of contacts.
3	MULTIMETER: Set to RX1 ohms range.	NA	Repeat step 2 for relay 8K3 on photo junction panel.	Multimeter should indicate less than 0.5 ohm.
4	MULTIMETER: Set to RX1 ohms range.	NA	Repeat step 2 for relay 8K4 on photo junction panel.	Multimeter should indicate less than 0.5 ohm.
5	POWER SOURCE: POWER switch: On ***Note.*** **Allow 15 minutes for warmup.**	NA	Connect +28 vdc test lead to terminal X1 and dc return lead to terminal X2 of relay 8K1 on photo junction panel.	NA
6	MULTIMETER: Set to RX1 ohms range.	NA	Check contacts A1 and A2 of relay 8K1 on photo junction panel.	Multimeter should indicate less than 0.5 ohm.
7	MULTIMETER: Set to RX1 ohms range.	NA	Connect +28 vdc test lead to terminal X1 and dc return lead to terminal X2 of relay 8K2 on photo junction panel. Check the following contacts on relay 8K2 on photo junction panel for continuity. A1 and A2 B1 and B2 C1 and C2 D1 and D2	Multimeter should indicate less than 0.5 ohm for each set of contacts.
8	MULTIMETER: Set to RX1 ohms range.	NA	Repeat step 7 for relay 8K3 on photo junction panel.	Multimeter should indicate less than 0.5 ohm.
9	MULTIMETER: Set to RX1 ohms range.	NA	Repeat step 7 for relay 8K4 on photo junction panel.	Multimeter should indicate less than 0.5 ohm.
10	POWER SOURCE: switch: Off.	NA	Disconnect test setup ________________	NA

Section IV. PHOTO CONTROL PANEL (UNIT 3)

4-8. Physical Tests and Inspections

a. Test Equipment and Materials.

(1) Tool Kit TK-77/GF.

(2) Vacuum cleaner (Federal stock number 7910-215-5786).

(3) Cleaning compound (Federal stock number 7930-395-9542).

(4) Lint free cloth (Federal stock number 8305-170-5062).

(5) Ethyl alcohol (grade II, class B, Federal Specification O-E-760).

(6) Camel's hair brush (Federal stock number 8020-245-4509).

b. Test Connections and Conditions.

(1) Disconnect and remove photo control panel from aircraft as directed in TM 11-1510-204-20-2/1.

(2) Disassemble the photo control panel to the degree necessary for accomplishing physical tests and inspection (para 3-14).

c. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	NA	PHOTO CONTROL PANEL: Controls may be in any position.	*a.* Inspect all controls and mechanical devices for loose or missing screws, washers, and nuts. *b.* Inspect all connectors and receptacles, including fuse holders, for looseness and damage. *c.* Inspect chassis for missing screws, fittings, and nuts. Inspect the condition of the finish and panel lettering. ***Note.*** Touchup painting is recommended in lieu of refinishing whenever practicable. Screw heads, binding posts, receptacles, and plated fastener parts will not be painted or polished with abrasives.	*a.* Screws, washers, and nuts must be tight; no missing parts. *b.* No evidence of looseness or damage. *c.* Screws, fittings, and nuts must be tight. No missing parts. External surfaces must be painted and panel lettering must be legible.
2	NA	PHOTO CONTROL PANEL: Controls may be in any position.	*a.* Set the SYS PWR switch to its READY, OPERATE, and OFF positions. *b.* Set the V/H switch to the MANUAL and AUTO positions. *c.* Set the MODE switch to the AUTO, PULSE, PULSE IMC, and NIGHT positions. *d.* Set the MOUNT switch to the L15°, L30°, 90°, R30° and R15° positions.	*a.* Switch should operate freely in all positions. *b.* Switch should operate freely in both positions. *c.* Switch should index properly and rotate freely between indexed positions. *d.* Switch should index properly and rotate freely between indexed positions.

9. Electrical Test

a. *Test Equipment and Materials.*

(1) Multimeter TS-352 B/U.

(2) Tool Kit TK-77/GF.

(3) Power source, +24 to +28.5 volts dc.

(4) Battery, 6 volt (Federal stock number 35-643-1310).

(5) Connector MS3126F-18-32S.

(6) Lamp socket MS90287-8 (4 required).

(7) Lamp MS25231-313 (4 required).

(8) Switch MS24655-221 (5 required).

(9) Switch MS25089-1A (MIL-S-8805/3).

(10) Terminal board MS27212-1-11.

(11) Wiring, No. 22 AWG (as required).

b. *Test Connections and Conditions.*

(1) Fabricate a test cable as shown in figure 3-6. Do not make connections to the +28-volt dc power source and 6-volt battery.

(2) On test cable, set switches S1, S2, and S4 through S6 to the off (open) position.

(3) Connect the fabricated cable to connector 3J7 of the photo control panel.

(4) Connect test cable (fig. 3-6) to +28-volt dc power source and 6-volt battery.

(5) Turn on the dc power source. Allow 15 minutes for warmup.

c. *Procedure.*

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	TEST CABLE: Switch S4: On (closed position).	PHOTO CONTROL PANEL: READY and OPERATE indicators: depress momentarily.	Observe the READY and OPERATE indicators on photo control panel.	The READY and OPERATE indicators should light momentarily.
2	TEST CABLE: Switch S1: On (closed position).	PHOTO CONTROL PANEL: V/H switch: MANUAL	Observe lamp DS1 on test cable	Lamp DS1 should light.
3	NA	PHOTO CONTROL PANEL: V/H switch: AUTO	Observe lamp DS1 on test cable	Lamp DS1 should go out momentarily and then light again.
4	TEST CABLE: Switch S1: Off (open position).	NA	Observe lamp DS1 on test cable	Lamp DS1 should go out.
5	TEST CABLE: Switch S2: On (closed position).	PHOTO CONTROL PANEL: MOUNT switch: L15°	Observe lamp DS2 on test cable	Lamp DS2 should light.
6	NA	PHOTO CONTROL PANEL: MOUNT switch: L30°	Observe lamp DS2 on test cable	Lamp DS2 should go out momentarily and then light again.
7	NA	PHOTO CONTROL PANEL: MOUNT switch: 90°	Observe lamp DS2 on test cable	Lamp DS2 should go out and remain off.
8	NA	PHOTO CONTROL PANEL: MOUNT switch: R30°	Observe lamp DS2 on test cable	Lamp DS2 should light.
9	NA	PHOTO CONTROL PANEL: MOUNT switch R15°	Observe lamp DS2 on test cable	Lamp DS2 should go out momentarily and then light again.
10	TEST CABLE: Switch S2: Off (open position).	PHOTO CONTROL PANEL: MOUNT switch: 90°	Observe lamp DS2 on test cable	Lamp DS2 should go out and remain off.
11	NA	PHOTO CONTROL PANEL: MODE switch: AUTO	Observe lamp DS3 on test cable	Lamp DS3 should remain out.
12	NA	PHOTO CONTROL PANEL: MODE switch: PULSE	Observe lamp DS3 on test cable	Lamp DS3 should light.
13	NA	PHOTO CONTROL PANEL: MODE switch: PULSE IMC	Observe lamp DS3 on test cable	Lamp DS3 should go out momentarily and then light again.
14	NA	PHOTO CONTROL PANEL: MODE switch: NIGHT	Observe lamp DS3 on test cable	Lamp DS3 should go out momentarily and then light again.
15	NA	PHOTO CONTROL PANEL: MODE switch: AUTO	Observe lamp DS3 on test cable	Lamp DS3 should go out.
			Note. Note the FRAMES REMAINING counter reading on the photo control panel before performing step 16.	
16	TEST CABLE: Switch S3: depress momentarily.	NA	Observe OPERATE indicator and FRAMES REMAINING counter on photo control panel.	OPERATE indicator should light and FRAMES REMAINING counter should subtract one digit.
17	TEST CABLE: Switch S5: On (closed position).	NA	Observe READY indicator on photo control panel.	READY indicator should light.
18	TEST CABLE: Switch S5: Off (open position).	NA	Observe READY indicator on photo control panel.	READY indicator should go out.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
19	NA	PHOTO CONTROL PANEL: SYS PWR switch: READY	Observe lamp DS4 on test cable	Lamp DS4 should light.
20	NA	PHOTO CONTROL PANEL: SYS PWR switch: OPERATE	Observe lamps DS3 and DS4 on test cable.	Lamps DS3 and DS4 should light.
21	NA	PHOTO CONTROL PANEL: SYS PWR switch: OFF	Observe lamps DS3 and DS4 on test cable.	Lamps DS3 and DS4 should go out.
22	TEST CABLE: Switch S6: On (closed position).	NA	Observe panel lights on photo control panel.	Panel lamps should light.
23	TEST CABLE: Switch S6: Off (open position).	NA	Observe panel lights on photo control panel.	Panel lamps should go out.
24	POWER SOURCE Switch: Off.	NA	Disconnect test setup.	

Section V. PHOTO SYSTEM ASSEMBLY (UNIT 1)

4-10. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Tool Kit TK-77/GF.

(2) Vacuum cleaner (Federal stock number 7910-215-5786).

(3) Cleaning compound (Federal stock number 8305-170-5062).

(5) Ethyl alcohol (grade II, class B, Federal Specification O-E-760).

(6) Camel's hairbrush (Federal stock number 8020-245-4509).

b. Test Connections and Conditions.

(1) Disconnect and remove photo system assembly from installation in aircraft as directed in TM 11-1510-204-20-2/1.

(2) Disassemble the photo system assembly to the degree necessary for accomplishing physical tests and inspection (para 3-15).

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	NA	NA	*a.* Inspect all fuses for proper rating and evidence of damage.	*a.* Fuses must not be damaged, and must have proper amperage rating.
			b. Check SPARE fuse holders	*b.* Each SPARE fuseholder must contain a fuse with proper amperage rating.
2	NA	NA	*a.* Inspect all mechanical assemblies for loose or missing screws, washers, and nuts.	*a.* Screws, washers, and nuts must be tight; no missing parts.
			b. Inspect all connectors and receptacles, including the fuse holder, for looseness and damage.	*b.* No evidence of looseness or damage.
			c. Inspect chassis for missing screws, fittings, and nuts. Inspect the condition of the finish and panel lettering.	*c.* Screws, fittings, and nuts must be tight; no missing parts. External surfaces must be painted and panel lettering must be legible.
			Note. **Touchup painting is recommended in lieu of refinishing whenever practicable. Screw heads, binding posts, receptacles and plated fastener parts will not be painted or polished with abrasives.**	

4-11. Electrical Test

a. Test Equipment and Materials.

(1) Multimeter TS-352 B/U.

(2) Tool Kit TK 77/GF.

(3) Power source, +24 to+ 28.5 volts dc.

(4) Power source, 109 to 116.5 volts ac, three-phase, 400 Hz.

(5) Connector MS2106E-22-55P.

(6) Connector MS3106E-22-21S.

(7) Lamp socket MS90287-9 (3 required).

(8) Lamp MS25231-313 (3 required).

(9) Switch MS25089-1A (2 required).

(10) Switch MS24655-221 (4 required).

(11) Switch MS25103-24 (2 required).

(12) Terminal board MS27212-1-23.

(13) Wire, electrical, No. 16 AWG (as required).

(14) Wire, electrical, No. 22 AWG (as required).

b. Test Connections and Conditions.

WARNING

Make sure that 115-volt ac, three-phase 400-Hz and +28-volt dc power sources are off before performing (1) through (4) below. Dangerous voltages of 115 volts ac and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate a test cable as shown in figure 3-9.

(2) On the test cable, set switches S1 through S3 and S5 through S7 to the off (open) position.

(3) Connect the test cable to connectors 1J1 and 1J2 on the photo system assembly.

(4) Connect test cable (fig. 3-9) to 115-volt ac, 400-Hz and +28-volt dc power sources.

(5) Turn on the ac and dc power sources. Allow 15 minutes for warmup.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	TEST CABLES: Switch S1: On (closed position).	NA	Observe lamp DS3 on test cables	Lamp DS3 should light.
2	MULTIMETER: Set to 250 vac range.	NA	NA	NA
3	TEST CABLES: Switch S2: On (closed position).	NA	Measure ac voltage between terminals 1(–) and 21(+) on test cable terminal board TB1.	Multimeter should indicate from 109 to 116.5 volts ac.
4	N/A	NA	Measure ac voltage between terminals 1(–) and 19(+) on test cable terminal board TB1.	Multimeter should indicate from 109 to 116.5 volts ac.
5	TEST CABLES: Switch S2: Off (open position).	NA	Observe multimeter	Multimeter should indicate 0 volt ac.
6	TEST CABLES: Switch S3: On (closed position).	NA	Measure ac voltage between terminals 1(–) and 20(+) on test cable terminal board TB1.	Multimeter should indicate from 109 to 116.5 volts ac.
7	TEST CABLES: Switch S3: Off (open position).	NA	Disconnect multimeter from test cable terminal board.	NA
8	TEST CABLES: Switch S4: depress momentarily.	NA	Observe lamp DS1 on test cable	Lamp DS1 should light momentarily.
9	TEST CABLES: Switch S8: depress momentarily.	NA	Observe lamp DS1 and DS2 on test cable.	Lamps DS1 and DS2 should light momentarily.
10	TEST CABLES: Switch S5: On (closed position) Switch S6: On (closed position).	NA	Observe lamp DS2 on test cable	Lamp DS2 should light.
11	MULTIMETER: Set to RX1 ohms range.	NA	Check continuity between terminals 11 and 18 on test cable terminal board.	Multimeter should indicate 0 ohms.
12	TEST CABLES: Switch S5: Off (open position).	NA	Observe lamp DS2 on test cable	Lamp DS2 should go out.
13	TEST CABLES: Switch S5: On (closed position) Switch S7: On (closed position).	NA	Observe lamp DS2 on test cable	Lamp DS2 should light.
14	MULTIMETER: Set RX1 ohms range.	NA	Check continuity between terminals 11 and 18 on test cable terminal board.	Multimeter should indicate 0 ohms.
15	TEST CABLES: Switches S1, S5, S6, S7: Off (open position).	NA	Observe lamps DS2 and DS3 on test cable.	Lamps DS2 and DS3 should go out.
16	POWER SOURCES: Power switches: Off.	NA	Disconnect test setup.	

Section VI. CAMERA PULSE PANEL (UNIT 6)

4-12. Phyiscal Tests and Inspection

a. Test Equipment and Materials.

(1) Tool Kit TK-77/GF.

(2) Vacuum cleaner (Federal stock number 7910-215-5786).

(3) Cleaning compound (Federal stock number 7930-395-9542).

(4) Lintfree cloth (Federal stock number 8305-170-5062).

(5) Ethyl alcohol (grade II, class B, Federal Specification O-E-760).

(6) Camel's hair brush (Federal stock number 8020-245-4509).

b. Test Connections and Conditions.

(1) Disconnect and remove camera pulse panel from the installation in the aircraft as directed in TM 11-1510-204-20-2/1.

(2) Disassemble camera pulse panel to the degree necessary for accomplishing physical tests and inspection (para 3-16).

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	NA	NA	*a.* Inspect the pushbutton switch for proper mounting.	*a.* Switch must be mounted securely.
			b. Inspect wiring lugs for proper installation.	*b.* Lugs must be properly crimped onto wires.
			c. Inspect wiring for damage	*c.* Wiring must be in good condition with no frayed insulation.
			d. Inspect panel for missing fittings and for the condition of the finish. Inspect panel for condition of lettering.	*d.* Fittings must be properly installed; no missing parts. External surfaces must be painted and lettering must be legible.
			Note. Touchup painting is recommended in lieu of refinishing whenever practicable. Screw heads, binding posts and plated fasteners parts will not be painted or polished with abrasives.	
2	NA	NA	Depress CAMERA pushbutton switch and then release.	Switch should depress and release freely.

4-13. Electrical Test

a. Test Equipment and Materials.

(1) Switch MS35058-22.

(2) Resistor RW24V100.

(3) Zener diode 1N1600.

(4) Terminal board MIL-T-55164/14, Type 8T6B.

(5) Wiring, No. 18 AWG (as required).

(6) Multimeter TS-352 B/U.

(7) Power source, +24 to +28.5 volts dc.

(8) Tool kit, TK-77/GF.

b. Test Connections and Conditions.

(1) Fabricate test cable as shown in figure 3-15. Do not connect test cable to dc power source.

(2) On test cable, set switch S1 to off (open) position.

(3) Connect test cable to camera pulse panel and dc power source as shown in figure 3-15.

(4) Turn on dc power source.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	TEST CABLE: Switch S1: On (closed position). *Note.* Allow 15 minutes for warm-up.	NA	Observe two front panel edge lamps on camera pulse panel.	Both edge lamps should light.
2	TEST CABLE: Switch S1: Off (open position).	NA	Observe two front panel edge ----------	Both edge lamps should go out.
3	POWER SOURCE: POWER switch: Off.	NA	NA	NA
4	MULTIMETER: Set to RX1 ohms range.	NA	Measure resistance between ground terminal on camera pulse panel and end of wire connected to ground terminal.	Multimeter should indicate 0 ohms.
5	MULTIMETER: Set to RX1 ohms range.	CAMERA PULSE PANEL: CAMERA pushbutton switch: Depress and hold.	Measure resistance between ground terminal on camera pulse panel and end of wire connected to CAMERA pushbutton switch.	Multimeter should indicate 0 ohms.
6	MULTIMETER: Set to RX10,000 ohms range.	CAMERA PULSE PANEL: CAMERA pushbutton switch: Released position.	Check resistance between ground terminal on camera pulse panel.	Multimeter should indicate infinite.
7	POWER SOURCE: POW-POWER switch: Off.	NA	Disconnect test setup.	

CHAPTER 5

GENERAL SUPPORT MAINTENANCE

Section I. GENERAL

–1. Scope of General Support Maintenance

ieneral support maintenance procedures include ll maintenance instructions performed by the ower maintenance categories (ch. 3) in addition o the information contained in this chapter. The naintenance duties assigned to the general support maintenance repairman of camera control ystem major components are listed below toether with references to the paragraphs covering pecific maintenance functions. Primarily the luties are as follows:

a. Manual V/H Control Panel (Unit 7). Perorm an operational check (para 5–5*a*); troublehooting procedures (para 5–5*b*); voltage and esistance measurements (para 5–5*c*); disassemly procedures (para 5–25*a*); and reassembly rocedures (para 5–25*b*).

(1) *DC power circuits.* Perform an operaional check (para 5–6*a*); troubleshooting proceures (para 5–6*b*); voltage and resistance measrements (para 5–6*c*); disassembly procedures para 5–28*a*); and reassembly procedures (para –28*b*).

(2) *Module 7A5.* Perform an operational heck (para 5–7*a*); troubleshooting procedures para 5–7*b*); voltage measurements (para 5–7*c* 1)); disassembly procedures (para 5–29*a*); and eassembly procedures (para 5–29*b*).

b. Photo Junction Panel (Unit 8). Perform an perational check (para 3–6*a*); troubleshooting rocedures (para 3–6*b*); resistance measurements para 3–6*c* (2)); disassembly procedures (para –13*a*); and reassembly procedures (para 3–13*b*).

c. Photo Control Panel (Unit 3). Perform an perational check (para 5–9*a*); troubleshooting rocedures (para 5–9*b*); voltage and resistance easurements (para 3–7*c*); disassembly proceures (para 5–34*a*); and reassembly procedures para 5–34*b*).

d. Photo System Assembly (Unit 1). Perform n operational check (para 5–10*a*); troubleshootg procedures (para 5–10*b*); voltage and resistance measurements (para 5–10*c*); disassembly procedures (para 5–35*a*); and reassembly procedures (para 5–35*b*).

(1) *Intervalometer module 1A1.* Perform operational check (para 5–11*a*); troubleshooting procedures (para 5–11*b*); voltage and resistance measurements (para 5–11*c*); disassembly procedures (para 5–36*a*); and reassembly procedures (para 5–36*b*).

(2) *Film drive amplifier module 1A2.* Perform an operational check (para 5–12*a*); troubleshooting procedures (para 5–12*b*); voltage and resistance measurements (para 5–12*c*); disassembly procedures (para 5–37*a*); and reassembly procedures (para 5–37*b*).

(3) *Printed circuit board and component assembly module 1A3.* Perform an operational check (para 5–13*a*); troubleshooting procedures (para 5–13*b*); voltage and resistance measurements (para 5–13*c*); disassembly procedures (para 5–39*a*); and reassembly procedures (para 5–39*b*).

e. Rotary Mount Actuator (Unit 2). Perform an operational check (para 5–14*a*); troubleshooting procedures (para 5–14*b*); voltage and resistance measurements (para 5–14*c*); disassembly procedures (para 5–40*a*); and reassembly procedures (para 5–40*b*).

f. Door Actuator (Unit 4). Perform an operational check (para 5–15*a*); troubleshooting procedure (para 5–15*b*); resistance measurements (para 5–15*c* (2)); disassembly procedures (para 5–43*a*); and reassembly procedures (para 5–43*b*).

g. Light Sensor (Unit 5). Perform an operational check (para 5–16*a*); troubleshooting procedures (para 5–16*b*); disassembly procedures (para 5–45*a*); and reassembly procedures (para 5–45*b*).

h. Camera Pulse Panel (134AV81400–1 or 134AV81400–3) (Unit 6). Perform an operational check (para 3–9*a*); troubleshooting procedures (para 3–9*b*); resistance measurements (para 3–

9c (2)); disassembly procedures (para 3-16*a*); and reassembly procedures (para 3-16*b*).

i. Pod Assembly (Unit 10). Refer to TM 11-6760-228-35-1 for maintenance instructions on pod assembly (Unit 10).

j. Camera (Unit 9). Refer to TM 11-6720-236-35 for maintenance instructions on camera (Unit 9).

k. Camera Mount A (Unit 11). Perform troubleshooting procedures (para 5-20); disassembly procedures (paras 5-49*a* and 5-50*a*); and reassembly procedures (paras 5-49*b* and 5-50*b*).

l. Camera Mount B (Unit 12). Perform troubleshooting procedures (para 5-20); disassembly procedures (paras 5-51*a* and 5-52*a*); and reassembly procedures (paras 5-51*b* and 5-52*b*).

m. Flight Line Tracker (Unit 13). Perform troubleshooting procedures (para 5-21); disassembly procedures (para 5-53*a*); and reassembly procedures (para 5-53*b*).

n. Right Oblique Sight (Unit 14). Perform troubleshooting procedures (para 5-22); disassembly procedures (para 5-54*a*); and reassembly procedures (para 5-54*b*).

o. Left Oblique Sight (Unit 15). Perform troubleshooting procedures (para 5-22); disassembly procedures (para 5-54*a*); and reassembly procedures (para 5-54*b*).

5-2. Tools, Test Equipment, and Materials Required

a. Tools. The tools listed in paragraph 3-2*a* are required for general support troubleshooting.

b. Test Equipment. The test equipment in paragraph 3-2*b* are required for general support troubleshooting. In addition, the following items should be available.

(1) Test Set, Analyzer, Camera LS-80A.

(2) Test Set, Control Panel, Focal Plane Shutter LS-78A.

(3) Voltmeter ME-202A/U (vtvm) (TM 11-6625-537-15).

(4) Timer, Digital, Electronic LA-387A (digital timer) (TM 11-6720-242-15).

(5) Oscilloscope AN/USM-281.

(6) Bridge, Resistance-Capacitance, General Radio Type 1650A; AN/URM-190.

NOTE

LA-233A is included in Test Set, Photographic Surveillance System Components LS-47A.

(7) Light Source, Calibrated LA-233A.

(8) Digital Voltmeter ME-218/GSM-64.

(9) AC Voltmeter ME-119/NPM-38 (a voltmeter).

(10) Digital Voltmeter ME-231/FYQ-5.

(11) Dc Multifunction Plug-In Unit, Mode 3444A (Hewlett-Packard Co.).

(12) Power supply, model LH-118A-FI (Lambert, Incorp.) (2 required).

(13) Power supply, model HB-250M (Ke co, Inc.)

c. Materials. The following materials shoul be available:

(1) Araldite 571CX (Ciba Co.).

(2) Beetle 216-8 (American Cyanamid Co.

(3) Xylol (Federal Specification TT-X 916).

(4) Diacetone alcohol (Federal Specificatio O-D-306).

(5) Araldite 820 (Ciba Co.).

(6) Butyl alcohol (Federal Specificatio TT-B-846).

(7) Liquid staking compound GE1201 (General Electric Co.).

(8) Molycote lubricating compound (Cl max Molybdenum Corp.).

(9) Solder SN60WARP2 (Federal Specifica tion QQ-S-571).

(10) Adhesive (Military Specification MIL C-4003).

(11) Adhesive, Eccobond solder 59C (Eme son and Cuming, Inc.).

(12) Lubricating oil, general purpose (LO (FSN9150-261-8164).

(13) Grease, molybdenum disulfide for lo and high temperature (FSN9150-753-4830).

(14) RTV compound, type 3140 (Dow Corn ing).

(15) Sealing compound, Loctite grade A, re (FSN8030-680-0889).

(16) Lacquer, acrylic resin type, purple (FS N8010-835-1424).

(17) Grease, aircraft and instrument (FSN 9150-261-8297).

(18) Antiseize compound (FSN8030-243 3285).

(19) Cleaning compound (FSN7930-395 9542).

(20) Potting compound PN 3C-130 (Churchill Chemical Corp.).

(21) Epoxy adhesive (Military Specificatio MIL-A-14042).

NOTE

Filters (22) through (25) below are included in Test Set, Photographic Surveillance System Components LS-47A.

(22) Filter, neutral density (25 percent trans-
ssibility) (CAI PN 2998-933-1).
(23) Filter, neutral density (8.0 percent nsmissibility) (CAI PN 2998-933-2).
(24) Filter, neutral density (1.6 percent nsmissibility) (CAI PN 2998-933-3).
(25) Filter, neutral density (0.5 percent nsmissibility) (CAI PN 2998-933-4).
(26) Connector MS3116P-20-16S.
(27) Terminal board MS27212-1-16.
(28) Switch MS35058-22.
(29) Switch MS25002-1.
(30) Indicator light MS25256-8 (2 re-red).
(31) Lamp MS25237-327 (2 required).
(32) Switch MS25103-24 (2 required).
(33) Switch MS35058-22 (9 required).
(34) Terminal board MS27212-1-20 (2 re-red).
(35) Terminal board MIL-T-55164/14, type 8TB6 (2 required).
(36) Connector MS3100A-14S-5P.
(37) Connector MS3126F-14-19S.
(38) Connector Model K600-8PCSCGD18 (95238).
(39) Transformer, P/N 1 HMQ07UK, (584-74).
(40) Zenor diode IN1600 (4.7 volts).
(41) Resistor RW24V100 (10 ohms ± 10%, 91W, wirewound).
(42) Resistor RN75B1101F, (1.1K, ± 1%, 1W) (5 required).
(43) Resistor RCR20G202JM (2K, ±5%, 1/2W).
(44) Resistor RW68V2R7 (2.7K, ±5%, 11W
(45) Wiring, No. 18AWG.

Section II. GENERAL SUPPORT TROUBLESHOOTING

WARNING

Dangerous voltages exist in the pod assembly (Unit 10) high voltage circuits after power has been removed. Use a ground rod with a series 5-kilohm, 10-watt resistor, and discharge all high voltage circuits before touching any of the components. The grounding is accomplished between the Xenon flashlamp metal connecting arms and the illuminator module chassis.

WARNING

Be careful when working on the 115-volt ac, 400-Hz, line connections and the 28-volt dc connections. Serious injury or death may result from contact with these terminals. Use insulated test probes when making the required voltage measurements. Insure that major component is disconnected from power source when touching internal parts.

3. General

. Troubleshooting at general support mainte-ice includes all the techniques outlined by the er category maintenance and any special or itional techniques required to isolate a defec-part. The general support maintenance pro-ures are not complete in themselves but sup-nent the procedures outlined in (TM 11-0-250-12 and direct support maintenance . 3 and 4). This chapter provides trouble-oting procedures which must be performed by general support maintenance repairman.

. Troubleshooting should be performed after major components (or parts of them) have removed from service. When troubles oc-, certain observations and measurements can nade that will help to determine the source of ibles. Usually, when troubleshooting (locali-on) is performed, it is done at the direct support maintenance. Paragraph 5-4 describes the systematic procedure to be followed which will enable the general support maintenance personnel to isolate the cause of the trouble and correct the fault.

5-4. Organization of General Troubleshooting Procedures

a. General. Three steps are used in troubleshooting any type of equipment. They are *sectionalization, localization,* and *isolation.* Sectionalization means tracing the fault to the major component. Localization means tracing the fault to the defective section or stage within a major component. Isolation means tracing the fault to the defective part. Some faults can often be isolated by detailed electrical, mechanical, and electronic checks.

b. Sectionalization Checks. Sectionalization of troubles is started with a troubleshooting chart provided in TM 11-6720-250-12.

c. Localization Checks. After the trouble has been sectionalized to a major component, make a general operational check (subparagraph *a* of paras 5-5 through 5-7, 5-9 through 5-16, and 5-20 through 5-22). The operational checks serve as a check of the localization technique. In addition, assemblies or subassemblies, or in some instances parts can be localized within the major components by the methods listed in (1) through (3) below.

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits or components. All visual signs should be analyzed to help locate the fault to a particular subchassis, stage, or part. Mechanical faults are most often localized through visual inspection.

(2) *Troubleshooting charts.* The trouble symptoms listed in the troubleshooting charts (subparagraph *b* of paras 5-5 through 5-7, 5-9 through 5-16, and 5-20) will aid in localizing trouble in a major component to a defective part, subassembly, or assembly.

(3) *Signal substitution.* Signal substitution procedures quickly enable localization of a trouble. An oscilloscope or RC bridge may be used in signal substitution procedures.

d. Isolation Checks. Isolation checks for individual assemblies and subassemblies will be performed at the general support maintenance level. Defective parts can be isolated by the methods listed in (1) and (2) below.

NOTE

When measuring positive voltage, connect the negative lead of the multimeter to chassis ground. When measuring negative voltages, connect the positive lead of the multimeter to chassis ground.

(1) *Voltage and resistance measurements.* Observe all cautions given to prevent transistor damage. Make voltage and resistance measurements in this equipment only as specified. When measuring voltages, use tape or sleeving to insulate the entire test prod except for the extreme tip. A momentary short circuit can ruin the transistor. (For example, if the base to collector is shorted out, excessive current would ruin the transistor.) Use resistor and capacitor color codes (fig. 5-2) to find value of components. Use voltage and resistance charts (subparagraph *c* of paras 3-5 through 3-8, 5-5 through 5-7, and 5-10 through 5-15) to find normal readings, a[nd] compare them with readings obtained.

(2) *Intermittent troubles.* In all tests, t[he] possibility of intermittent troubles should not [be] overlooked. If present, this type of trouble ma[y] often be made evident by tapping or jarring t[he] equipment. Check the wiring and connections [of] the assemblies and subassemblies of the maj[or] component under test.

Figure 5-1. Resistor color code (Not used).

Figure 5-2. Capacitor color code.
[Located in back of manual]

5-5. Manual V/H Control Panel (Unit 7) Troubleshooting

General support troubleshooting procedures f[or] the manual V/H control panel are given belo[w].

a. Operational Check.

NOTE

Remove cover from the manual V/H control panel to allow access to the test jacks.

WARNING

Make sure that 115-volt ac, 400-Hz, and +28-volt dc power sources are off before performing steps (1) through (5) below. Dangerous voltages of 115 volts ac, 400 Hz, and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate test cable as shown in figu[re] 5-3.

(2) Connect the connector P1 on test cab[le] (fig. 5-3) to connector 7J1 on manual V/H co[n]trol panel.

(3) Set switches on manual V/H contr[ol] panel as follows:

(*a*) POWER switch 7S1 to OFF positio[n].

(*b*) OVERRIDE switch 7S2 to MANUA[L] position.

(*c*) VELOCITY-KNOTS thumbwheels [to] 050.

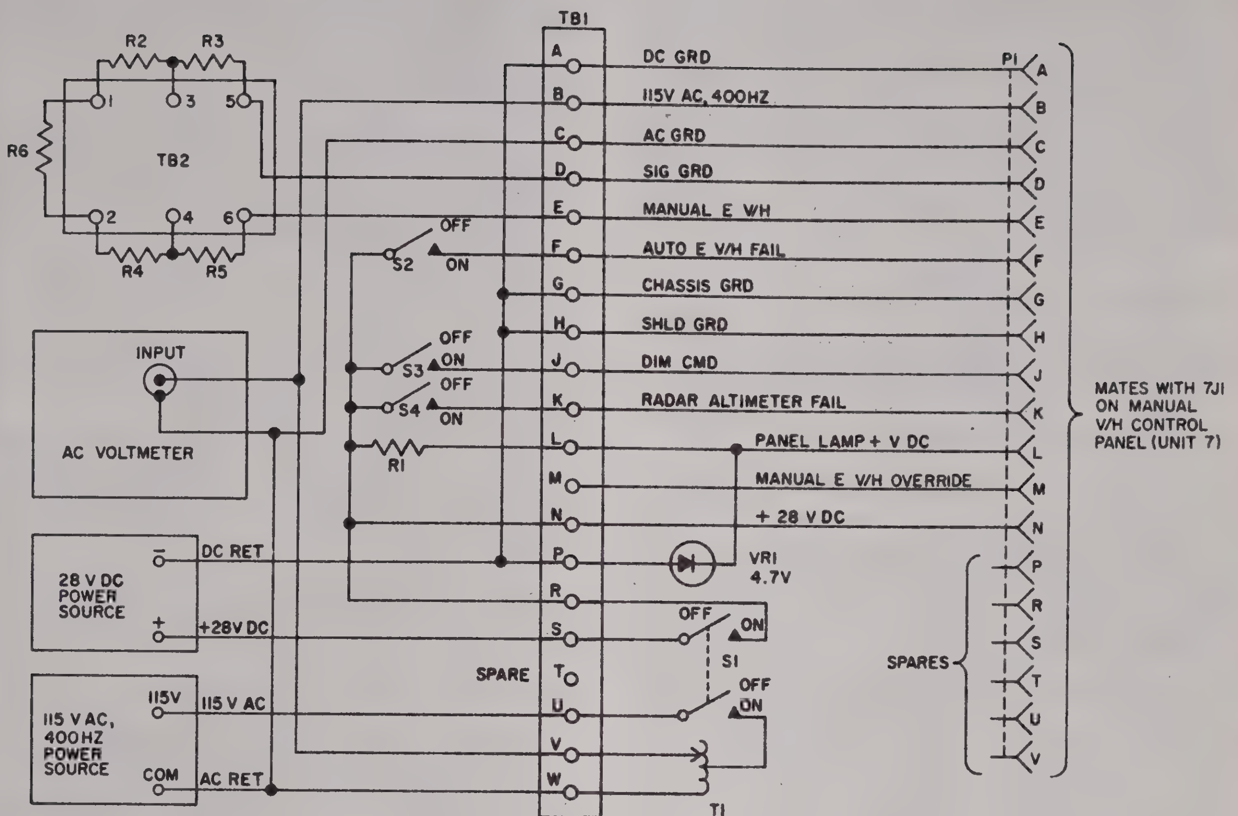
(*d*) ALTITUDE-FEET thumbwheels [to] 00050.

(4) Set switches S1, S2, S3 and S4 on te[st] cable to their OFF positions.

(5) Connect test cable (fig. 5-3) to 11[5] volts ac, 400-Hz and +28-volts dc power sourc[e].

(6) Turn ac and dc power sources on. [S]et test cable switches S1 and S4 on. Allow [...] minutes for warmup.

(7) Adjust transformer T1 on test ca[ble] until ac voltmeter indicates 115 ±5 volts ac. T[...]



NOTES:

1. USE FOLLOWING PARTS:

REF DES	DESCRIPTION OR MIL STANDARD
SWITCH S1	MS25103-24
SWITCH S2, S3, S4	MS35058-22
TERMINAL BOARD TB1	MS27212-1-20
TERMINAL BOARD TB2	MIL-T-55164/14 TYPE 8TB6
CONNECTOR P1	MS3126F-14-19S
RESISTOR R1	RW24V100 10 OHMS, ±10%, 91W, WIRE WOUND
RESISTOR R2, R3, R4, R5, R6	RN75B1101F, 1, 100 OHMS ± 1%, 1 W
TRANSFORMER T1	P/N 1HMQ07UK (58474)
ZENER DIODE VR1	1N1600
WIRING	NO. 18 AWG

2. USE CONVENIENT LENGTHS OF WIRE AS REQUIRED.

3. REFERENCE DESIGNATORS ARE ARBITRARILY ASSIGNED.

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Figure 5-3. Manual V/H control panel, cable fabrication diagram and test setup.

front panel edge lamps, VELOCITY-KNOTS thumbwheel lamps, and ALTITUDE FEET thumbwheel lamps on manual V/H control panel should light.

(8) Set POWER switch 7S1 on manual V/H control panel to ON position. The AUTO FAIL indicator on manual V/H control panel should remain off.

NOTE

In the following steps (9), (20) through (24), Digital Voltmeter ME-231/FYQ-5 with dc multifunction plug-in unit is used to measure dc voltage unless otherwise specified.

(9) Using the digital voltmeter, connect leads between the test jacks on manual V/H control panel as indicated below. Refer to the result/indication column for proper indications.

Digital voltmeter		Result/indication
+	–	
		Digital voltmeter
7A1TP7	7A1TP1	–19 to –29 vdc
7A1TP7	7A1TP2	–90 to –130 vdc
7A1TP6	7A1TP7	+130 to +170 vdc
7A1TP4	7A1TP3	+4 to +6 vdc
7A1TP3	7A1TP5	–2.64 to –3.96 vdc

(10) Set switch S2 on test cable to on position. The AUTO FAIL indicator on manual V/H control panel should flash at a rate from 5 to 15 flashes per 10 seconds.

(11) Momentarily depress PRESS TO RESET switch 7S3 on manual V/H control panel. The AUTO FAIL indicator on manual V/H control panel stops flashing and remains constantly lit. However, AUTO FAIL indicator brightness is reduced as compared to the on period in (10) above.

(12) Set switch S2 on test cable to off position. The AUTO FAIL indicator on manual V/H control panel should go out.

(13) Set switch S4 on test cable to off position. The AUTO FAIL indicator on manual V/H control panel should flash at a rate from 5 to 15 flashes per 10 seconds.

(14) Momentarily depress PRESS TO RESET switch 7S3 on manual V/H control panel. The AUTO FAIL indicator on manual V/H control panel stops flashing and remains constantly lit. However, AUTO FAIL indicator brightness is reduced as compared to the on period in (13) above.

(15) Set switch S2 on test cable to on position. The AUTO FAIL indicator on manual V/H control panel remains constantly lit.

(16) Set switch S3 on test cable to on position. The AUTO FAIL indicator on manual V/H panel remains constantly lit at reduced brightness as compared to (15) above.

(17) Set switches S2 and S3 on test cable to off position and switch S4 on test cable to on position. The AUTO FAIL indicator on manual V/H control panel goes out.

(18) Depress and hold AUTO FAIL TEST pushbutton switch 7S4 on manual V/H control panel. The AUTO FAIL indicator on manual V/H control panel should flash at a rate from 5 to 15 flashes per 10 seconds.

(19) Release AUTO FAIL TEST pushbutton switch 7S4 on manual V/H control panel. The AUTO FAIL indicator on manual V/H control panel goes out.

(20) Using the digital voltmeter, connect leads between terminals M (+) and P (–) of TB1 on test cable (fig. 5-3). The digital voltmeter should indicate 0.0 volt dc.

(21) Set OVERRIDE switch 7S2 on manual V/H control panel to AUTO position. The digital voltmeter should indicate from +26.5 to +29.5 volts dc.

(22) Set OVERRIDE switch 7S2 on manual V/H control panel to MANUAL position. Disconnect digital voltmeter from terminals M (+) and P (–) of TB1 on test cable.

(23) Using the digital voltmeter, connect leads between the test jacks 7TP8 (–) and 7A1TP7 (+) on manual V/H control panel. The digital voltmeter should indicate from –4 to –6 volts dc.

(24) Using the digital voltmeter, connect leads between the test jacks 7TP9 (+) and 7A1TP7 (–) on manual V/H control panel. The digital voltmeter should indicate from +123 to +133 volts dc.

NOTE

In (25), (27) through (29), and (31) below, Digital Voltmeter ME-218/GSM-64 is used to measure dc voltages.

(25) Using the digital voltmeter, connect leads between terminals E (+) and D (–) of TB1 on test cable (fig. 5-3). Set VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels on manual V/H control panel to the positions indicated in the following table. Refer to the result/indication column for indication on digital voltmeter that is expected for each position of VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels.

LOCITY-KNOTS nbwheels settings	ALTITUDE-FEET thumbwheels settings	Result/indication (manual E V/H output)
		Digital voltmeter (vdc)
)50	00050	+49.294 to + 51.306
)70	02000	+ 1.725 to + 1.795
100	00050	+98.588 to +102.612
150	05000	+ 1.478 to + 1.539
180	07500	+ 1.183 to + 1.231
180	15000	+ 0.591 to + 0.615
195	00100	+96.123 to +100.046
200	00500	+19.717 to + 20.522
200	00950	+10.377 to + 10.801
200	02000	+ 4.929 to + 5.130
200	06000	+ 1.643 to + 1.710
220	04550	+ 2.383 to + 2.480
235	08550	+ 1.354 to + 1.410
250	15000	+ 0.821 to + 0.855
250	20000	+ 0.616 to + 0.641
300	00150	+98.588 to +102.612
300	20000	+ 0.739 to + 0.769
400	10000	+ 1.971 to + 2.052
450	12550	+ 1.767 to + 1.839
499	49990	+ 0.491 to + 0.512

(26) Adjust transformer T1 on test cable til ac voltmeter indicates 121 ±5 volts ac.

(27) Set VELOCITY-KNOTS thumbwheels manual V/H control panel to 050 and AL-TUDE-FEET thumbwheels on manual V/H ntrol panel to 00050. The digital voltmeter ould indicate from + 49.294 to +51.306 volts

(28) Set VELOCITY-KNOTS thumbwheels manual V/H control panel to 100 and AL-TUDE-FEET thumbwheels on manual V/H ntrol panel to 00050. The digital voltmeter ould indicate from + 98.588 to +102.612 volts

(29) Set VELOCITY-KNOTS thumbwheels on manual V/H control panel to 499 and AL-TITUDE-FEET thumbwheels on manual V/H control panel to 49990. The digital voltmeter should indicate from + 0.491 to + 0.512 volt dc.

(30 Adjust transformer T1 on test cable until ac voltmeter indicates 108 ±5 volts ac.

(31) Repeat procedures in (27) through (29) above.

(32) Set POWER switch 7S1 on manual V/H control panel to OFF position.

(33) Set all switches on test cable to their off positions.

(34) Disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3–2) and wiring diagram (fig. 3–3).

NOTE

If either module 7A1 or 7A5 is replaced, the adjustment procedures in paragraph 5–55*a* must be performed.

CAUTION

This equipment is transistorized. Use multimeter RX100 ohms range to measure circuit resistances, thereby preventing possible damage or destruction to transistors due to excessive current.

No.	Trouble symptom	Probable cause	Checks and corrective measures
	VELOCITY-KNOTS thumbwheel lamps, ALTITUDE-FEET thumbwheel lamps, and front panel edge lamps do not light (step 7).	Defective wiring	Check for continuity between pin L of connector 7J1 and center conductor of connector 7J3. Check for continuity between pin L of connector 7J1 and lamp terminals on VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels. Repair or replace wiring if defective.
	Individual lamps in VELOCITY-KNOTS or ALTITUDE-FEET thumbwheels do not light (step 7).	*a.* Defective lamp(s) *b.* Defective wiring	*a.* Check lamp(s) and replace if defective. *b.* Check for continuity between appropriate VELOCITY-KNOTS or ALTITUDE-FEET lamp terminal and pin L of connector 7J1. Repair or replace wiring if defective.
	Both front panel edge lamps do not light (step 7).	*a.* Defective front panel edge lamps *b.* Defective wiring	*a.* Check lighting panel assembly and replace if defective. *b.* Check for continuity between pin L of connector 7J1 and center

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
			conductor of connector 7J3. Repair or replace wiring if defective.
4	One of the two front panel edge lamps do not light (step 7).	Defective lamp	Check lighting panel assembly and replace if defective.
5	AUTO FAIL indicator is flashing (step 8).	*a.* Defective module 7A1	*a.* Using Digital Voltmeter ME-231/FYQ-5, connect leads between test jacks 7A1TP5 (–) and 7A1TP3 (+). The digital voltmeter should indicate from –2.64 to –3.96 vdc. If voltage is out of tolerance, replace or check module (para 5-6).
		b. Defective resistor 7R5	*b.* Check resistor for 240 ± 12 ohms resistance. If necessary, replace defective resistor.
		c. Defective AUTO FAIL TEST switch 7S4.	*c.* Check continuity of AUTO FAIL TEST switch (when depressed) and replace if defective.
		d. Defective module 7A5	*d.* Replace or check module (para 5-7).
		e. Defective wiring	*e.* Check for continuity between pin K of connector 7J1 and resistor 7R5. Check for continuity between other side of resistor 7R5 and pin D of connector 7J2 with AUTO FAIL TEST switch depressed. Check for continuity between pin F of connector 7J1 and pin J of connector 7J2. Repair or replace wiring if defective.
6	AUTO FAIL indicator is constantly lit (step 8).	*a.* Defective AUTO FAIL indicator or PRESS TO RESET switch 7S3.	*a.* Check switch and indicator terminals. Replace switch or indicator if defective.
		b. Defective module 7A5	*b.* Replace or check module (para 5-7).
		c. Defective wiring	*c.* Check for continuity between terminal A of AUTO FAIL indicator and pin L of connector 7J2. Check for continuity between terminal E of AUTO FAIL indicator and pin A of connector 7J2. Repair or replace wiring if defective.
7	None of the voltages are present at test jacks 7A1TP1, 7A1TP2, 7A1TP6, 7A1TP4, and 7A1TP5 (step 9).	*a.* Defective fuse 7F1	*a.* Check fuse and replace if defective.
		b. Defective fuseholder 7XF1	*b.* Check fuseholder and replace if necessary.
		c. Defective dc power circuits.	*c.* Check dc power circuity (para 5-6).
8	One or more voltages at test jacks 7A1TP1, 7A1TP2, 7A1TP6, 7A1TP4, or 7A1TP5 are not present or are out of tolerance (step 9).	Defective dc power circuits	Check dc power circuitry (para 5-6).
9	AUTO FAIL indicator does not light (step 10).	*a.* Defective AUTO FAIL indicator	*a.* Check for low resistance (with lamps installed) between terminals A and E on AUTO FAIL indicator. If necessary, replace defective lamp(s).

n No.	Trouble symptom	Probable cause	Checks and corrective measures
		b. Defective filter 7FL2	*b.* Check filter for low resistance, and replace if defective.
		c. Defective module 7A5	*c.* Replace or check module (para 5–7).
		d. Defective wiring	*d.* Check for continuity between terminal A of AUTO FAIL indicator and pin L of connector 7J2. Check for continuity between terminal E of AUTO FAIL indicator and pin A of connector 7J2. Repair or replace wiring if defective.
	AUTO FAIL indicator is constantly lit (step 10).	*a.* Defective PRESS TO RESET switch 7S3.	*a.* Check for infinite resistance between terminals B and D. If necessary, replace defective switch.
		b. Defective module 7A5	*b.* Replace or check module (para 5–7).
		c. Defective wiring	*c.* Check for continuity between terminal A of PRESS TO RESET switch and pin L of connector 7J2. Check for continuity between terminal E of PRESS TO RESET switch and pin A of connector 7J2. Repair and replace wiring if defective.
	Only one lamp in the AUTO FAIL indicator is flashing (step 10).	Defective lamp in AUTO FAIL indicator that is not flashing.	Check indicator lamp(s) and replace if defective.
	AUTO FAIL indicator does not flash from 5 to 15 flashes-per-second (step 10).	Defective module 7A5	Replace or check module (para 5–7).
	AUTO FAIL indicator does not stop flashing (step 11).	*a.* Defective PRESS TO RESET switch 7S3.	*a.* Check for continuity between terminals B and D with PRESS TO RESET switch depressed. If necessary, replace defective switch.
		b. Defective module 7A5	*b.* Replace or check module (para 5–7).
		c. Defective wiring	*c.* Check for continuity between terminal D of PRESS TO RESET switch 7S3 and pin H of connector 7J2. Check for continuity between terminal B of PRESS TO RESET switch 7S3 and output terminal of 7FL2. Repair or replace wiring if defective.
	AUTO FAIL indicator does not light (step 11).	Defective module 7A5	Replace or check module (para 5–7).
	AUTO FAIL indicator brightness does not decrease (step 11).	Defective module 7A5	Replace or check module (para 5–7).
	AUTO FAIL indicator does not go out (step 12).	*a.* Defective module 7A5	*a.* Replace or check module (para 5–7).
		b. Defective wiring	*b.* Check for continuity between pin F of connector 7J1 and pin J of connector 7J2. Repair or replace wiring if defective.
	AUTO FAIL indicator does not light (step 13).	*a.* Defective module 7A5	*a.* Replace or check module (para 5–7).
		b. Defective wiring	*b.* Check for continuity between pin K of connector 7J1 and resistor

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
			7R5. Check for continuity between other side of resistor 7R5 and terminal 2 of AUTO FAIL TEST switch 7S4. Check for continuity between terminal 1 of AUTO FAIL TEST switch 7S4 and pin D of connector 7J2. Repair or replace wiring if defective.
18	AUTO FAIL indicator is constantly lit (step 13).	*a.* Defective PRESS TO RESET switch 7S3.	*a.* Check for infinite resistance between terminals B and D of PRESS TO RESET switch. If necessary, replace defective switch.
		b. Defective module 7A5	*b.* Replace or check module (para 5-7).
		c. Defective wiring	*c.* Check for continuity between terminal A of PRESS TO RESET switch 7S3 and pin of connector 7J2. Check for continuity between terminal E of PRESS TO RESET switch 7S3 and pin A of connector 7J2. Repair or replace wiring if defective.
19	AUTO FAIL indicator does not flash from 5 to 15 flashes per 10 seconds (step 13).	Defective module 7A5	Replace or check module (para 5-7).
20	AUTO FAIL indicator does not stop flashing (step 14).	*a.* Defective PRESS TO RESET switch 7S3.	*a.* Check for continuity between terminals B and D with PRESS TO RESET switch depressed. If necessary, replace defective switch.
		b. Defective module 7A5	*b.* Replace or check module (para 5-7).
		c. Defective wiring	*c.* Check for continuity between terminal D of PRESS TO RESET switch 7S3 and pin H of connector 7J2. Check for continuity between terminal B of PRESS TO RESET switch 7S3 and output terminal 7FL2. Repair or replace wiring if defective.
21	AUTO FAIL indicator does not light (step 14).	Defective module 7A5	Replace or check module (para 5-7).
22	AUTO FAIL indicator brightness does not decrease (step 14).	Defective module 7A5	Replace or check module (para 5-7).
23	AUTO FAIL indicator does not remain constantly lit (step 15).	Defective module 7A5	Replace or check module (para 5-7).
24	AUTO FAIL indicator brightness does not decrease (step 16).	*a.* Defective module 7A5	*a.* Replace or check module (para 5-7).
		b. Defective wiring	*b.* Check for continuity between pin J of connector 7J1 and pin B of connector 7J2. Repair or replace wiring if defective.
25	AUTO FAIL indicator does not go out. (step 17).	Defective module 7A5	Replace or check module (para 5-7).
26	AUTO FAIL indicator does not light (step 18).	*a.* Defective AUTO FAIL TEST switch 7S4.	*a.* Check for infinite resistance of AUTO FAIL TEST switch (when depressed) and replace if defective.

m No.	Trouble symptom	Probable cause	Checks and corrective measures
		b. Defective capacitor 7C14	b. Check capacitor and replace if defective.
		c. Defective module 7A5	c. Replace or check module (para 5-7).
7	AUTO FAIL indicator does not flash from 5 to 15 flashes per 10 seconds (step 18).	Defective module 7A5	Replace or check module (para 5-7).
8	AUTO FAIL indicator does not go out (step 19).	a. AUTO FAIL TEST switch 7S4	a. Check continuity of AUTO FAIL TEST switch and replace if defective.
		b. Defective resistor 7R5	b. Check resistor for 240 ± 12 ohms resistance. If necessary, replace defective resistor.
		c. Defective module 7A5	c. Replace or check module (para 5-7).
9	Digital voltmeter indication is greater than 0.0 volt dc (step 20).	a. Defective capacitor 7C12	a. Check capacitor and replace if defective.
		b. Defective OVERRIDE switch 7S2	b. Check operation of OVERRIDE switch and replace if defective.
		c. Defective wiring	c. Check for continuity between pin M of connector 7J1 and terminal 3 on OVERRIDE switch 7S2. Repair or replace wiring if defective.
0	Digital voltmeter does not indicate from +26.5 to +29.5 volts dc (step 21).	a. Defective resistor 7R3	a. Check resistor for 20 ±1 ohm resistance. If necessary, replace defective resistor.
		b. Defective OVERRIDE switch 7S2	b. Check for continuity of OVERRIDE switch (AUTO position) and replace if defective.
		c. Defective wiring	c. Check for continuity between output terminal of 7FL2 and resistor 7R3. Check for continuity between other side of resistor 7R3 and pin M of connector 7J1 with OVERRIDE switch 7S2 in AUTO position. Repair or replace wiring if defective.
1	Digital voltmeter does not indicate from -4 to -6 volts dc (step 23).	a. Module 7A5 requires adjustment	a. Perform adjustment procedures in paragraph 5-55*a*.
		b. Defective module 7A5	b. Replace or check module (para 5-7).
		c. Defective wiring	c. Check for continuity between pin 1 of connector 7P1 and pin P of connector 7J2. Check for continuity between pin 13 of connector 7P1 and pin T of connector 7J2. Check for continuity between test jack 7TP8 and pin N of connector 7J2. Repair or replace wiring if defective.
2	Digital voltmeter does not indicate from +123 to +133 volts dc (step 24).	a. Defective capacitor 7C15	a. Check capacitor and replace if defective.
		b. Defective resistor 7R2	b. Check resistor 7R2 for 8,200 ± 410 ohms resistance. If necessary, replace defective resistor.
		c. Defective module 7A5	c. Replace or check module (para 5-7).
		d. Defective wiring	d. Check for continuity between pin 16 of connector 7P1 and pin U

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
			of connector 7J2. Check for continuity between pin S of connector 7J2 and test jack 7TP9. Repair or replace wiring if defective.
33	Digital voltmeter indications are not within tolerance for various settings of VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels (step 25).	*a.* Module 7A5 requires adjustment	*a.* Perform adjustment procedures in paragraph 5-55*a*.
		b. Defective VELOCITY-KNOTS thumbwheels.	*b.* Check voltages and resistance of VELOCITY-KNOTS thumbwheels, refer to paragraph 5-5*c* as an aid. If necessary, replace defective thumbwheels.
		c. Defective ALTITUDE-FEET thumbwheels.	*c.* Check voltages and resistances of ALTITUDE-FEET thumbwheels, refer to 5-5*c* as an aid. If necessary, replace defective thumbwheels.
		d. Defective amplifier 7AR1 or associated part(s) 7R1, 7R4, 7C3, 7C10, 7C11, 7C13, or 7CR1.	*d.* Check voltages and resistances of amplifier and associated parts, refer to paragraph 5-5*c* as an aid. If necessary, replace any defective part(s).
		e. Defective wiring	*e.* Check continuity of all wiring associated with amplifier 7AR1. Repair or replace wiring if defective.
34	Digital voltmeter indicates 0 volt dc for all settings of VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels (step 25).	*a.* Defective diode 7CR1	*a.* Check diode and replace if defective.
		b. Defective amplifier 7AR1	*b.* Check voltages and resistances of amplifier, refer to paragraph 5-5*c* as an aid. If necessary, replace defective amplifier.
		c. Defective wiring	*c.* Check all wiring associated with amplifier 7AR1. Repair or replace wiring if defective.
35	Digital voltmeter indications are not within tolerance for certain settings of VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels (step 25).	*a.* Defective VELOCITY-KNOTS thumbwheels.	*a.* Check voltages and resistances of VELOCITY-KNOTS thumbwheels, refer to paragraph 5-5*c* as an aid. If necessary, replace defective thumbwheels.
		b. Defective ALTITUDE-FEET thumbwheels.	*b.* Check voltages and resistances of ALTITUDE-FEET thumbwheels, refer to paragraph 5-5*c* as an aid. If necessary, replace thumbwheels.
			Note. If -110 ± 20 volts dc is out of tolerance, Zener diode 7VR1 may be defective instead of module 7A1.
36	Digital voltmeter does not indicate from +49.294 to +51.306 volts dc (step 27).	*a.* Defective module 7A1	*a.* Check voltages of test jacks 7A1TP1 (-24 ± 5 volts dc), 7A1TP2 (-110 ± 20 volts dc), and 7A1TP6 (+150 ± 20 volts dc) in reference to 7A1TP7 (signal ground). If any voltage is out of tolerance, replace or check defective module (para 5-6).
		b. Defective module 7A5	*b.* Replace or check module (para 5-7).
37	Digital voltmeter does not indicate from +98.588 to +102.612 volts dc (step 28).	*a.* Defective module 7A1	*a.* Check voltages of test jacks 7A1TP1 (-24 ± 5 volts dc, 7A1TP2 (-110 ±20 volts dc), and 7A1TP6 (+150 ± 20 volts

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
			dc) in reference to 7A1TP7 (signal ground). If any voltage is out of tolerance, replace or check defective module (para 5-6).
		b. Defective module 7A5	*b.* Replace or check module (para 5-7).
38	Digital voltmeter does not indicate from +0.491 to +0.512 volts dc (step 29).	*a.* Defective module 7A1	*a.* Check voltages of test jacks 7A1TP1 (-24 ±5 volts dc), 7A1TP2 (-110 ±20 volts dc), and 7A1TP6 (+150 ±20 volts dc) in reference to 7A1TP7 (signal ground). If any voltage is out of tolerance, replace or check defective module (para 5-6).
		b. Defective module 7A5	*b.* Replace or check module (para 5-7).
39	Digital voltmeter is not within tolerance for certain settings of VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels (step 31).	*a.* Defective module 7A1	*a.* Check voltages of test jacks 7A1TP1 (-24 ± 5 volts dc), 7A1TP2 (-110 ± 20 volts dc), and 7A1TP6 (+150 ± 20 volts dc) in reference to 7A1TP7 (signal ground). If any voltage is out of tolerance, replace or check defective module (para 5-6).
		b. Defective module 7A5	*b.* Replace or check module (para 5-7).

c. Voltage and Resistance (V & R) Measurements.

(1) *Voltage measurements.* To perform voltage measurements on manual V/H control panel, proceed as follows:

(*a*) Connect the connector P1 on test cable (fig. 5-3) to connector 7J1 on manual V/H control panel.

(*b*) Turn ac and dc power sources (fig. 5-3) on.

(*c*) Set switches S1, S2, S3 and S4 on test cable to on (closed) position. Adjust transformer T1 on test cable (fig. 5-3), until ac voltmeter indicates 115 volts ac.

(*d*) Set POWER switch 7S1 on manual V/H control panel to ON position. Allow 15 minutes for warmup.

(*e*) Momentarily depress PRESS TO RESET switch 7S3 on manual V/H control panel. The AUTO FAIL indicator should remain constantly lit.

NOTE

For additional voltage measurements on the manual V/H control panel, refer to paragraph 3-5*c*(1).

(*f*) Using the Digital Voltmeter ME-218/GSM-64, perform the voltage measurements on pins on connectors, test jacks, or terminals as indicated below.

Voltmeter		VELOCITY-KNOTS thumbwheels settings	ALTITUDE-FEET thumbwheels settings	Voltage (vdc)
+	−			
7J2-A	7J2-L	NA	NA	+26.5 to +29.5
7J2-B	7J2-C	NA	NA	+26.5 to +29.5
7J2-D	7J2-C	NA	NA	+26.5 to +29.5
7J2-E	7J2-C	NA	NA	+26.5 to +29.5
7J2-C	7J2-F	NA	NA	−2.64 to −3.96
Note. The following indications are obtained with the PRESS TO RESET switch 7S3 depressed and held.				
7J2-H	7J2-C	NA	NA	+26.5 to +29.5
7J2-J	7J2-C	NA	NA	+26.5 to +29.5

Voltmeter +	Voltmeter −	VELOCITY-KNOTS thumbwheels settings	ALTITUDE-FEET thumbwheels settings	Voltage (vdc)
7J2-K	7J2-C	NA	NA	+4.0 to +6.0
7J2-T	7J2-N	NA	NA	-4.0 to -6.0
7J2-T	7J2-P	NA	NA	-19.0 to -29.0
7J2-S	7J2-T	NA	NA	+123.0 to +133.0
7J2-U	7J2-T	NA	NA	+130.0 to +170.0
7AR1-2	7AR1-(-)	NA	NA	-90.0 to -130.0
7AR1-(+)	7AR1-2	NA	NA	+123.0 to +133.0
7TP10	7A1TP7	050	00050	49.294 to 51.306
7TP10	7A1TP7	070	02000	1.725 to 1.795
7TP10	7A1TP7	100	00050	98.588 to 102.612
7TP10	7A1TP7	150	05000	+1.478 to +1.539
7TP10	7A1TP7	180	07500	+1.183 to +1.231
7TP10	7A1TP7	180	15000	+0.591 to +0.615
7TP10	7A1TP7	195	00100	+96.123 to +100.046
7TP10	7A1TP7	200	00500	+19.717 to +20.522
7TP10	7A1TP7	200	00950	+10.377 to +10.801
7TP10	7A1TP7	200	02000	+4.929 to +5.130
7TP10	7A1TP7	200	06000	+1.643 to +1.710
7TP10	7A1TP7	220	04550	+2.383 to +2.480
7TP10	7A1TP7	235	08550	+1.354 to +1.410
7TP10	7A1TP7	250	15000	+0.821 to +0.855
7TP10	7A1TP7	250	20000	+0.616 to +0.641
7TP10	7A1TP7	300	00150	+98.588 to +102.612
7TP10	7A1TP7	300	20000	+0.739 to +0.769
7TP10	7A1TP7	400	10000	+1.971 to +2.052
7TP10	7A1TP7	450	12550	+1.767 to +1.839
7TP10	7A1TP7	499	49990	+0.491 to +0.512

NOTE

For additional resistance measurements on the manual V/H control panel, refer to paragraph 3-5*c*(2).

(2) *Resistance measurements*. Note that this equipment is transistorized. The resistance measurements in the following chart are obtained with no power applied to the manual V/H control panel, with no external connections to connector 7J1, and thumbwheels disconnected from external circuitry. Using the RC bridge, perform the resistance measurements across input and output terminals of appropriate VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels as indicated below. Do not make any other resistance measurements on manual V/H control panel.

VELOCITY-KNOTS thumbwheels settings	ALTITUDE-FEET thumbwheels settings	Resistance (ohms)
050	----------	9,975 to 10,025
070	----------	13,951 to 14,049
100	----------	19,960 to 20,040
150	----------	29,865 to 30,135
180	----------	35,784 to 36,216
195	----------	38,649 to 39,351
200	----------	39,880 to 40,120
235	----------	46,671 to 47,329
250	----------	49,725 to 50,275
300	----------	59,760 to 60,240
400	----------	79,640 to 80,360
450	----------	89,370 to 90,630
499	----------	98,453 to 101,147
	00050	997 to 1,002
	00100	1,999 to 2,001
	00150	2,991 to 3,009
	00500	9,975 to 10,025
	00950	18,867 to 19,133
	02000	39,960 to 40,040
	04550	90,363 to 91,637

VELOCITY-KNOTS thumbwheels settings	ALTITUDE-FEET thumbwheels settings	Resistance (ohms)
	05000	99,750 to 100,250
	06000	119,640 to 120,360
	07500	149,100 to 150,900
	08550	169,204 to 172,795
	10000	199,800 to 200,200
	12250	243,652 to 246,347
	15000	298,950 to 301,050
	20000	399,200 to 400,800
	49990	985,316 to 1,012,284

5-6. Manual V/H Control Panel (Unit 7) DC Power Circuits Troubleshooting

General support troubleshooting procedures for the manual V/H control panel dc power circuits are given below. The dc power circuits include the POWER switch 7S1; 0.5 AMP fuse 7F1; line filter 7FL1; three power transformers 7T1, 7T2, and 7T3; module 7A1; and associated parts.

a. Operational Check.

NOTE

Remove cover from the manual V/H control panel to allow access to test jacks.

WARNING

Make sure that 115-volt ac, 400-Hz, and +28-volt dc power sources are off before performing (1) below. Dangerous voltages of 115 volts ac, 400 Hz, and +28 volts dc are present at terminals when power sources are on.

(1) Perform (1) through (8) of paragraph 5-5*a*.

NOTE

In (2) through (6) below, Digital Voltmeter ME-231/FYQ5 with dc multifunction plug-in unit is used to measure the dc voltages.

(2) Using the digital voltmeter, connect leads between test jacks 7A1TP7 (+) and 7A1-TP1 (–) on manual V/H control panel. The digital voltmeter should indicate from –19 to –29 volts dc.

(3) Using the digital voltmeter, connect leads between test jacks 7A1TP7 (+) and 7A1-TP2 (–) on manual V/H control panel. The digital voltmeter should indicate from –90 to –130 volts dc.

(4) Using the digital voltmeter, connect leads between test jacks 7A1TP6 (+) and 7A1-TP7 (–) on manual V/H control panel. The digital voltmeter should indicate from +130 to +170 volts dc.

(5) Using the digital voltmeter, connect leads between test jacks 7A1TP4 (+) and 7A1-TP3 (–) on manual V/H control panel. The digital voltmeter should indicate from +4 to +6 volts dc.

(6) Using the digital voltmeter, connect leads between test jacks 7A1TP3 (+) and 7A1-TP5 (–) on manual V/H control panel. The digital voltmeter should indicate from –2.64 to –3.96 volts dc.

(7) Set POWER switch 7S1 on manual V/H control panel to OFF position.

(8) Set all switches on test cable to their off position.

(9) Disconnect test setup.

b. Troubleshooting Chart. Steps referenced in *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3-2) wiring diagrams (figs. 3-3 and 5-4) and parts location diagram (fig. 5-31).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Digital Voltmeter does not indicate from –19 to –29 volts dc (step 2).	*a.* Defective Zener diode 7A1VR3	*a.* Check Zener diode and replace if defective.
		b. Defective diode(s) 7A1CR9, and/or 7A1CR10.	*b.* Check diode(s) and replace if defective.
		c. Defective capacitor 7A1C1	*c.* Check capacitor and replace if defective.
		d. Defective resistor 7A1R8	*d.* Check resistor 240 ± 12 ohms resistance. If necessary, replace defective resistor.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		e. Defective capacitor 7C8	*e.* Check capacitor and replace if defective.
		f. Defective capacitor(s) 7C5 and/or 7C6.	*f.* Check capacitor(s) and replace if defective.
		g. Defective transformer 7T3	*g.* Check transformer and replace if defective.
		h. Defective printed circuit board 7A1 or wiring.	*h.* Check continuity of printed circuit board 7A1 and associated wiring. Repair or replace wiring if defective.
2	Digital voltmeter does not indicate from –90 to –130 volts dc (step 3).	*a.* Defective Zener diode 7VR1	*a.* Check Zener diode and replace if defective.
		b. Defective diode(s) 7A1CR1 through 7A1CR4.	*b.* Check diode(s) and replace if defective.
		c. Defective resistor 7A1R5	*c.* Check resistor for 1,000 ± 50 ohms resistance. If necessary, replace defective resistor.
		d. Defective resistor(s) 7A1R1 and/or 7A1R2.	*d.* Check both resistors for 100 ± 5K ohm resistance. If necessary, replace defective resistor(s).
		e. Defective capacitor(s) 7A1C1 and/or 7A1C2.	*e.* Check capacitor(s) and replace if defective.
		f. Defective capacitor(s) 7C1 and/or 7C2.	*f.* Check capacitor(s) and replace if defective.
		g. Defective transformer 7T1	*g.* Check transformer and replace if defective.
		h. Defective printed circuit board 7A1 or wiring.	*h.* Check continuity of printed circuit board 7A1 and associated wiring. Repair or replace wiring if defective.
3	Digital voltmeter does not indicate from +130 to +170 volts dc (step 4).	*a.* Defective resistor(s) 7A1R3 and/or 7A1R4.	*a.* Check both resistor(s) for 100 ± 5K ohms resistance. If necessary, replace defective resistor(s).
		b. Defective capacitor(s) 7A1C3 and/or 7A1C4.	*b.* Check capacitor(s) and replace if defective.
		c. Defective printed circuit board 7A1 or wiring.	*c.* Check continuity of printed circuit board 7A1 and associated wiring. Repair or replace wiring if defective.
4	Digital voltmeter does not indicate from +4 to +6 volts dc (step 5).	*a.* Defective Zener diode 7A1VR1	*a.* Check Zener diode and replace if defective.
		b. Defective diode(s) 7A1CR5 through 7A1CR8.	*b.* Check diode(s) and replace if defective.
		c. Defective resistor 7A1R6	*c.* Check resistor for 15 ± 1 ohms resistance. If necessary, replace defective resistor.
		d. Defective capacitor 7C1	*d.* Check capacitor and replace if defective.
		e. Defective capacitor(s) 7C3 and/or 7C4.	*e.* Check capacitor(s) and replace if defective.
		f. Defective transformer 7T2	*f.* Check transformer and replace if defective.
		g. Defective printed circuit board 7A1 or wiring.	*g.* Check continuity of printed circuit board 7A1 and associated wiring. Repair or replace wiring if defective.
5	Digital voltmeter does not indicate from –2.64 to –3.96 volts dc (step 6).	*a.* Defective Zener diode 7A1VR2	*a.* Check zener diode and replace if defective.
		b. Defective resistor 7A1R7	*b.* Check resistor for 120 ± 6 ohms resistance. If necessary, replace defective resistor.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		c. Defective capacitor 7C9	*c.* Check capacitor and replace if defective.
		d. Defective circuit board 7A1 or wiring.	*d.* Check continuity of printed circuit board 7A1 and associated wiring. Repair or replace wiring if defective.

c. Voltage and Resistance (V & R) Measurements.

(1) *Voltage measurements.* To perform voltage measurements on manual V/H control panel dc power circuits, proceed as follows:

NOTE

Make sure all modules are installed in manual V/H control panel.

(*a*) Connect the connector P1 on test cable (fig. 5-3) to connector 7J1 on manual V/H control panel.

(*b*) Turn on ac and dc power sources (fig. 5-3) on.

(*c*) Set switches S2 and S3 on test cable to their off positions and switches S1 and S4 on test cable to their on (closed) positions. Adjust transformer T1 on test cable (fig. 5-3) until ac voltmeter indicates 108 ±5 volts ac.

(*d*) Set POWER switch 7S1 on manual V/H control panel to ON position. Allow 15 minutes for warmup.

(*e*) Using the Digital Voltmeter ME-231/FYP-5 (dc voltage) and ac voltmeter (ac voltages), perform the voltage measurements on pins of connector 7A1J1 as indicated below. Repeat voltage measurements in chart below with transformer T1 on test cable (fig. 5-3) adjusted to 115 ±5 volts ac and 121 ±5 volts ac on ac voltmeter, respectively. The voltages listed in the following chart are measured at the three input voltages of 108 volts ac, 115 volts ac, and 121 volts ac.

Voltmeter		Voltage
+	–	
13	1	–19.0 to –29.0 vdc
2	3	–2.64 to –3.96 vdc
4	2	+4.0 to +6.0 vdc
5	2	
2	6	
7	13	
8	2	
9	2	
10	13	
11	13	
13	12	
13	14	–90.0 to –130.0 vdc
15	13	
16	13	+130.0 to +170.0 vdc

(2) *Resistance measurements.* The resistance measurements in the following chart are obtained with no power applied to the manual V/H control panel, connector 7A1J1 disconnected from connector 7P1, and power transformers 7T1, 7T2 and 7T3 disconnected from external circuitry, Using the RC bridge, perform the resistance measurements on pins of connector 7A1J1 and at terminals of power transformers 7T1, 7T2, and 7T3 as indicated below.

R C bridge		Resistance (ohms)
–	+	
7T1-1	7T1-2	
7T1-4	7T1-3	
7T1-4	7T1-5	
7T2-1	7T2-2	
7T2-4	7T2-3	
7T2-4	7T2-5	
7T3-1	7T3-2	
7T3-4	7T3-3	
7T3-4	7T3-5	
7A1J1-7	7A1J1-12	
7A1J1-12	7A1J1-7	
7A1J1-12	7A1J1-15	
7A1J1-15	7A1J1-12	
7A1J1-1	7A1J1-12	228 to 252
7A1J1-1	7A1J1-13	
7A1J1-13	7A1J1-1	
7A1J1-6	7A1J1-8	
7A1J1-8	7A1J1-6	
7A1J1-8	7A1J1-5	
7A1J1-5	7A1J1-8	
7A1J1-5	7A1J1-9	
7A1J1-9	7A1J1-5	
7A1J1-9	7A1J1-6	
7A1J1-6	7A1J1-9	
7A1J1-6	7A1J1-3	114 to 126
7A1J1-2	7A1J1-3	
7A1J1-3	7A1J1-2	
7A1J1-4	7A1J1-2	
7A1J1-2	7A1J1-4	
7A1J1-5	7A1J1-4	14 to 16
7A1J1-10	7A1J1-16	
7A1J1-16	7A1J1-10	
7A1J1-16	7A1J1-11	

R C bridge		Resistance (ohms)
−	+	
7A1J1-11	7A1J1-16	
7A1J1-11	7A1J1-14	
7A1J1-14	7A1J1-11	
7A1J1-14	7A1J1-10	
7A1J1-10	7A1J1-14	
7A1J1-13	7A1J1-16	190K to 210K
7A1J1-10	7A1J1-13	190K to 210K

5-7. Manual V/H Control Panel (Unit 7) Module 7A5 Troubleshooting

General support troubleshooting procedures for the manual V/H control panel module 7A5 (includes modules 7A5A2, 7A5A3, and 7A5A4) are given below.

a. Operational Check. The operational check for module 7A5 is divided into four parts. The first part (1) pertains to the test setup. Parts (2) through (4) pertain to the operational check of 7A5A2, 7A5A3, and 7A5A4, respectively.

NOTE

Remove cover and module 7A5 from the manual V/H control panel.

(1) *Test setup.*

NOTE

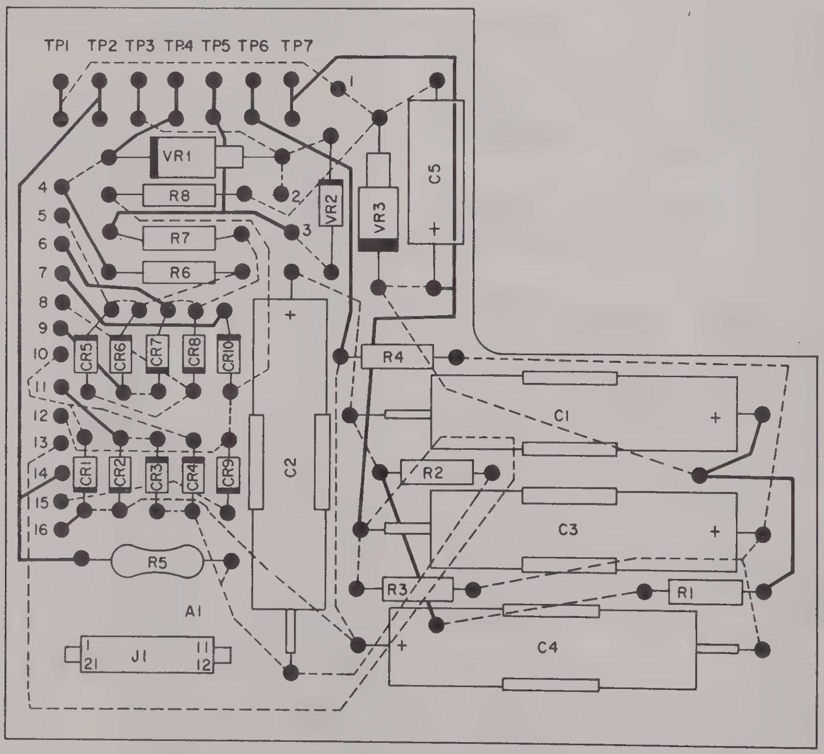
Connections shown in figure 5-5 (broken lines) are not to be made until instructed to in (4) below.

WARNING

Make sure that PS-1 and PS-2 power supplies and +28-volts dc power source are off before performing (*a*) through (*d*) below. Dangerous voltages of +28 volts dc are present at terminals when power source is on.

(*a*) Fabricate test cable as shown in figure 5-5.

(*b*) Connect the connector J1 on test cable (fig. 5-5) to connector on module 7A5.



NOTES:
1. CIRCUITS VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ----- WIRING ON BACK OF BOARD.
4. ▬▬ WIRING ON FRONT OF BOARD.
5. NUMBERS 1 THROUGH 16 ARE CONNECTED TO CORRESPONDING PINS OF CONNECTOR J1.
6. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO.7 AND ASSEMBLY NO. A1 (7A1).

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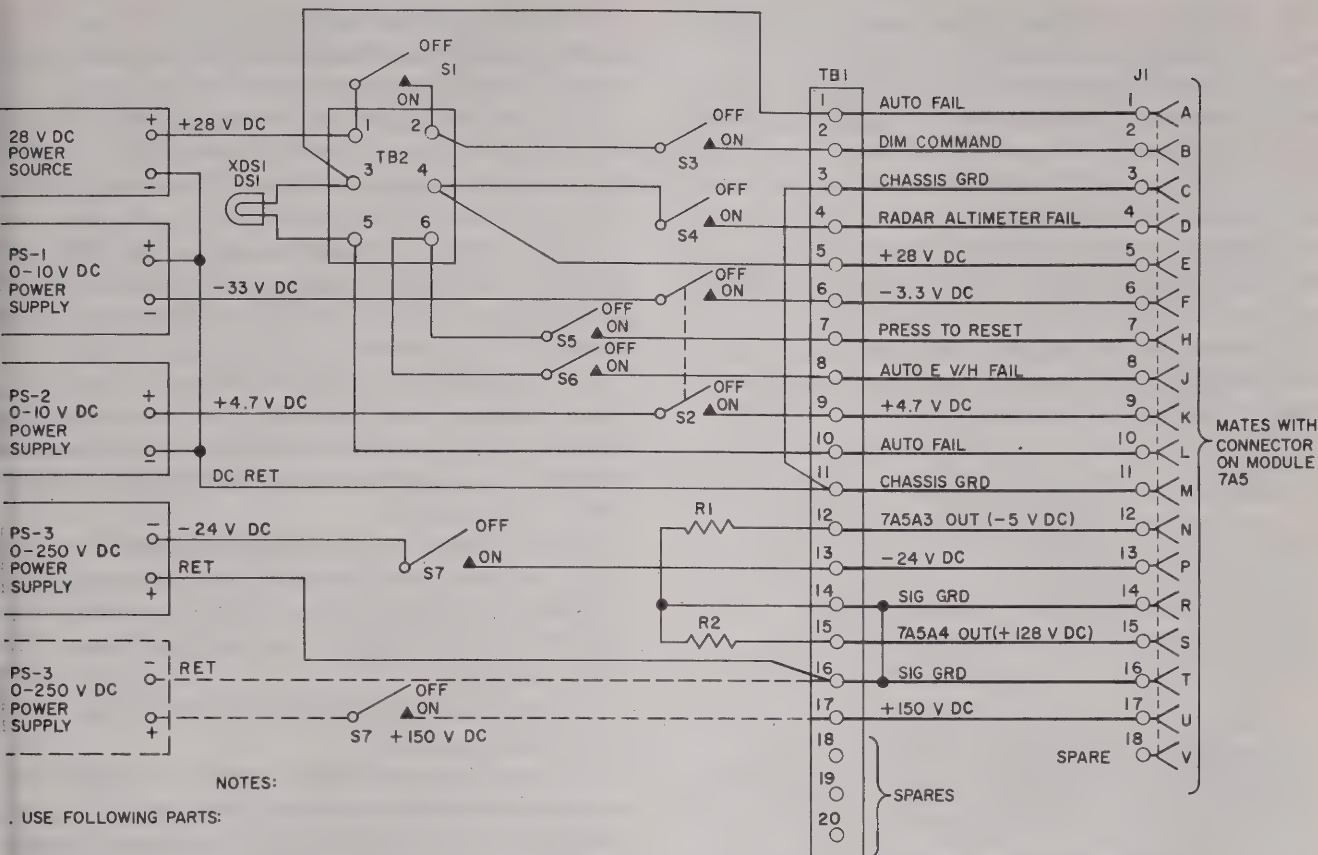
Figure 5-4. Manual V/H control panel module 7A1, wiring diagram.



NOTES:

. USE FOLLOWING PARTS:

REF DES	DESCRIPTION OF MIL STANDARD
CONNECTOR J1	MODEL: K600-8PCSCGD18 (95238)
TERMINAL BOARD TB1	MS27212-1-20
TERMINAL BOARD TB2	MIL-T-55164/14, TYPE 8TB6
POWER SUPPLY PS-1, PS-2	MODEL: LH-118-A-FM (82033)
POWER SUPPLY PS-3	MODEL: HB-250M (85604)
SWITCH S1, S3, S4, S5, S6, S7	MS35058-22
SWITCH S2	MS25103-24
INDICATOR LIGHT XDS1	MS25256-8
LAMP DS1	MS25237-327
RESISTOR R1	RCR20G202JM 2K, ±5%, 1/2 W
RESISTOR R2	RW68V2R7 2700, OHMS, ±5%, 11W
WIRING	NO. 18 AWG

. USE CONVENIENT LENGTHS OF WIRE AS REQUIRED.

REFERENCE DESIGNATORS ARE ARBITRARILY ASSIGNED.

INSTRUCTIONS FOR PARTS AND WIRING CONNECTIONS SHOWN IN BROKEN LINES ARE GIVEN IN TEXT.

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Figure 5-5. Manual V/H control panel module 7A5, cable fabrication diagram and test setup.

(*c*) Set switches S1 through S7 on test cable to their off positions.

(*d*) Connect test cable (fig. 5-5) to +28-volt dc power source and PS-1, PS-2, and PS-3 power supplies.

(*e*) Turn +28 vdc power source on. Allow 15 minutes for warmup.

(*f*) Turn PS-1 power supply on and adjust its front panel controls until the front panel meter indicates -3.3 volts dc.

(*g*) Turn PS-2 power supply on and adjust its front panel controls until the front panel meter indicates +4.7 volts dc.

NOTE

Do not turn on PS-3 power supply for this is accomplished in (3) and (4) below.

(2) *Module 7A5A2 operational check.*

(*a*) Perform all steps in (1) above.

NOTE

Indicator DS1 on test cable primarily functions as a load. Unless otherwise directed in the following steps, disregard the condition of the indicator.

(*b*) Set switch S1 on test cable to on position. Allow 15 minutes for warmup.

NOTE

In the following steps, the multimeter and Digital Voltmeter ME-218/GSM-64 are used to make dc voltage measurements and oscilloscope is used to observe waveforms.

(*c*) Using the multimeter on the +50 vdc range, connect leads between terminals 3 (-) and 5 (+) on module 7A5A2. The multimeter should indicate from +26.5 to +29.5 volts dc.

(*d*) Using the multimeter on the +50 vdc range, connect leads between terminal 3 (-) on module 7A5A2 and contact B2 (+) on relay 7A5A2K1. The multimeter should indicate from +26.5 to +29.5 volts dc.

(*e*) Using the multimeter on the +50 vdc range, connect leads between terminal 3 (-) on module 7A5A2 and terminal 1 (+) on module 7A5. The multimeter should indicate from +26.5 to +29.5 volts dc.

(*f*) Using the multimeter on the +50 vdc range, connect leads between terminals 3 (-) and 10 (+) on module 7A5A2. The multimeter should indicate from +26.5 to +29.5 volts dc.

(*g*) Set switch S1 on test cable to off position and switch S2 on test cable to on position.

(*h*) If necessary, readjust PS-1 and PS-2 power supplies to obtain -3.3-volt dc and +4.7-volt dc outputs, respectively.

(*i*) Using the multimeter on the -10 vdc range, connect leads between terminals 6 (-) and 11 (+) on module 7A5A2. The multimeter should indicate -3.3 volts dc.

(*j*) Using the multimeter on the +10 vdc range, connect leads between terminals 3 (-) and 9 (+) on module 7A5A2. The multimeter should indicate +4.7 volts dc.

(*k*) Using the multimeter on the -10 vdc range, connect leads between base of transistor 7A5A2Q6 (-) and terminal 3 (+) on module 7A5A2. The multimeter should indicate from -2.8 to -3.8 volts dc.

(*l*) Using the multimeter on the -10 vdc range, connect leads between base of transistor 7A5A2Q7 (-) and terminal 3 (+) on module 7A5A2. The multimeter should indicate from -2.8 to -3.8 volts dc.

(*m*) Set switches S1 and S4 on test cable to their on positions.

(*n*) Using the multimeter on the +50 vdc range, connect leads between terminals 3 (-) and 4 (+) on module 7A5A2. The multimeter should indicate from +26.5 to +29.5 volts dc.

(*o*) Using the multimeter on the +2.5 vdc range, connect leads between terminal 3 (-) on module 7A5A2 and base of transistor 7A5A2Q6 (+). The multimeter should indicate from -0.6 to +0.6 volt dc.

(*p*) Using the multimeter on the +2.5 vdc range, connect leads between terminal 3 (-) on module 7A5A2 and collector of transistor 7A5A2Q6 (+). The multimeter should indicate from -0.6 to +0.6 volt dc.

(*q*) Using the multimeter on the +2.5 vdc range, connect leads between terminal 3 (-) on module 7A5A2 and base of transistor 7A5A2Q5 (+). The multimeter should indicate from -0.6 to +0.6 volt dc.

(*r*) Using the multimeter on the +10 vdc range, connect leads between terminal 3 (-) on module 7A5A2 and collector of transistor 7A5A2Q5 (+). The multimeter should indicate from +4.2 to +5.2 volts dc.

(*s*) Set switch S4 on test cable to off position.

(*t*) Using the multimeter on the +2.5 vdc range, connect leads between terminal 3 (-) on module 7A5A2 and base of transistor 7A5A2Q5 (+). The multimeter should indicate from -0.6 to +0.6 volt dc.

(*u*) Using the multimeter on the +2.5 vdc ange, connect leads between terminal 3 (–) on nodule 7A5A2 and collector of transistor 7A5A-Q5 (+). The multimeter should indicate from 0.6 to +0.6 volt dc.

(*v*) Set switches S4 and S6 on test cable o their on positions.

(*w*) Using the multimeter on the +50 vdc ange, connect leads between 3 (–) and 8 (+) n module 7A5A2. The multimeter should indiate from +26.5 to +29.5 volts dc.

(*x*) Using the digital voltmeter, connect eads between terminal 3 (–) on module 7A5A2 nd base of transistor 7A5A2Q7 (+). The digital oltmeter should indicate from –0.06 to +0.06 olt dc.

(*y*) Using the multimeter on the +2.5 vdc ange, connect leads between terminal 3 (–) on nodule 7A5A2 and collector of transistor 7A5A-Q7 (+). The multimeter should indicate from 0.6 to +0.6 volt dc.

(*z*) Set switch S6 on test cable to off potion.

(*aa*) Using the multimeter on the +10 vdc ange, connect leads between terminal 3 (–) on nodule 7A5A2 and terminal 5 (+) on flip-flop A5A2Z2. The multimeter should indicate from 4.2 to +5.2 volts dc.

(*ab*) Using the multimeter on the +10 vdc ange, connect leads between terminal 3 (–) on nodule 7A5A2 and terminal 9 (+) on flip-flop A5A2Z2. The multimeter should indicate from 4.2 to +5.2 volts dc.

(*ac*) Using the multimeter on the +2.5 vdc ange, connect leads between terminal 3 (–) on nodule 7A5A2 and terminal 6 (+) on flip-flop A5A2Z2. The multimeter should indicate from).6 to +0.6 volt dc.

(*ad*) Using the multimeter on the +2.5 lc range, connect leads between terminal 3 (–) n module 7A5A2 and terminal 8 (+) on quad ate 7A5A2Z1. The multimeter should indicate om –0.6 to +0.6 volt dc.

(*ae*) Using the multimeter on the +2.5 lc range, connect leads between terminal 3 (–) n module 7A5A2 and anode of diode 7A5A2-R1 (+). The multimeter should indicate from .6 to +0.6 volt dc.

(*af*) Using the multimeter on the +2.5 lc range, connect leads between terminal 3 (–) module 7A5A2 and base of transistor 7A5A-Q1 (+). The multimeter should indicate from .6 to +0.6 volt dc.

(*ag*) Set switch S6 on test cable to on potion.

(*ah*) Using the multimeter on the +10 vdc range, connect leads between terminal 3 (–) on module 7A5A2 and terminal 6 (+) on flip-flop 7A5A2Z2. The multimeter should indicate from +4.2 to +5.2 volts dc.

(*ai*) Using the multimeter on the +2.5 vdc range, connect leads between terminal 3 (–) on module 7A5A2 and terminal 9 (+) on flip-flop 7A5A2Z2. The multimeter should indicate from –0.6 to +0.6 volt dc.

(*aj*) Using the oscilloscope, connect leads between terminal 3 (–) on module 7A5A2 and terminal 2 (+) on quad gate 7A5A2Z1. The oscilloscope waveform should be a pulse train from 4.2 to 5.2 volts peak-to-peak at a frequency from 0.5 to 1.5 pulse-per-second.

(*ak*) Using the oscilloscope, connect leads between terminal 3 (–) on module 7A5A2 and terminal 6 (+) on quad gate 7A5A2Z1. The oscilloscope waveform should be a pulse train from 4.2 to 5.2 volts peak-to-peak at a frequency from 0.5 to 1.5 pulse-per-second.

(*al*) Using the oscilloscope, connect leads between terminal 3 (–) on module 7A5A2 and the anode of diode 7A5A2CR1 (+). The oscilloscope waveform should be a pulse train from 1 to 1.4 volt peak-to-peak at a frequency from 0.5 to 1.5 pulse-per-second.

(*am*) Using the oscilloscope, connect leads between terminals 3 (–) and 10 (+) on module 7A5A2. The oscilloscope waveform should be a pulse train from 26.5 to 29.5 volts peak-to-peak at a frequency from 0.5 to 1.5 pulse-per-second.

(*an*) Momentarily press switch S5 on test cable to on position.

(*ao*) Using the multimeter on the +2.5 vdc range, connect leads between terminal 3 (–) on module 7A5A2 and terminal 5 (+) on flip-flop 7A5A2Z2. The multimeter should indicate from –0.6 to +0.6 volt dc.

(*ap*) Using the multimeter on the +2.5 vdc range, connect leads between terminal 3 (–) on module 7A5A2 and terminal 6 (+) on flip-flop 7A5A2Z2. The multimeter should indicate from –0.6 to +0.6 volt dc.

(*aq*) Using the multimeter on the +10 vdc range, connect leads between terminal 3 (–) on module 7A5A2 and terminal 9 (+) on flip-flop 7A5A2Z2. The multimeter should indicate from +4.2 to +5.2 volts dc.

(*ar*) Using the multimeter on the +10 vdc range, connect leads between terminal 3 (–) on module 7A5A2 and terminal 6 (+) on quad gate 7A5A2Z1. The multimeter should indicate from +4.1 to +5.3 volts dc.

(*as*) Using the multimeter on the +10 vdc range, connect leads between cathode of diode 7A5A2CR3 (–) and contact B2 (+) on relay 7A5A2K1. The multimeter should indicate from +8.5 to +9.5 volts dc.

(*at*) Using the multimeter on the +2.5 vdc range, connect leads between contacts B1 (–) and B3 (+) on relay 7A5A2K1. The multimeter should indicate from –0.6 to +0.6 volt dc.

(*au*) Set switch S3 on test cable to on position.

(*av*) Using the multimeter on the +50 vdc range, connect leads between terminals 3 (–) and 2 (+) on module 7A5A2. The multimeter should indicate from +26.5 to +29.5 volts dc.

(*aw*) Using the multimeter on the +10 vdc range, connect leads between contacts B1 (–) and B3 (+) on relay 7A5A2K1. The multimeter should indicate from +9 to +10 volts dc.

(*ax*) Set switches S1, S2, S3 and S6 on test cable to their off positions. Turn PS–1 and PS–2 power supplies to their off position.

(*ay*) Disconnect test setup.

(3) *Module 7A5A3 operational check.*

NOTE

The operational check of module 7A5A3 requires the use of PS–3 power supply, switch S7, and resistor R1 on the test cable (fig. 5–5). The PS–3 power supply, switch S7 and connections used for module 7A5A3 operational check are shown in solid lines in figure 5–5.

(*a*) Perform steps (*a*) through (*c*) of (1) above.

NOTE

Make sure test cable (fig. 5–5) is connected to PS–3 power supply.

(*b*) Turn PS–3 power supply on and adjust its front panel controls until the front panel meter indicates –24 volts dc.

(*c*) Set switch S7 on test cable to on position. Allow 15 minutes for warmup.

NOTE

In (d) and (f) through (i) below, Digital Voltmeter ME–231/FYQ–5 with dc multifunction plug-in unit is used to measure the dc voltages.

(*d*) Using the digital voltmeter, connect leads between terminals 13 (–) and 14 (+) on module 7A5A3. The digital voltmeter should indicate –24 volts dc. If necessary, readjust PS–3 power supply front panel controls until digital voltmeter indicates –24 volts dc.

(*e*) Using the digital voltmeter, connect leads between terminals 12 (–) and 14 (+) on module 7A5A3.

(*f*) Slowly adjust potentiometer 7A5A3-R2 fully clockwise and then fully counterclockwise while observing digital voltmeter indication. The digital voltmeter should indicate a minimum linear output voltage range from –4.0 to –6.0 volts dc.

(*g*) Adjust potentiometer 7A5A3R2 until the digital voltmeter indicates –5.03 volts dc.

(*h*) Adjust front panel controls on PS–3 power supply until the front panel meter indicates –19 volts dc. The digital voltmeter should indicate –5.03 volts dc.

(*i*) Adjust front panel controls on PS–3 power supply until the front panel meter indicates –29 volts dc. The digital voltmeter should indicate –5.03 volts dc.

(*j*) Set switch S7 on test cable to off position and turn PS–3 power supply to off position.

(*k*) Disconnect test setup.

(4) *Module 7A5A4 operational check.*

NOTE

The operational check of module 7A5A4 requires the use of PS–3 power supply, switch S7, and resistor R2 on the test cable (fig. 5–5). The PS–3 power supply, switch S7, and connections used for module 7A5A4 operational check are shown in broken lines in figure 5–5.

WARNING

Make sure that PS–3 power supply is off before performing (*a*) and (*b*) below. Dangerous voltages of +250 volts dc are present at terminals when power source is on.

(*a*) Perform (*a*) and (*b*) of (1) above.

(*b*) Connect test cable (fig. 5–5) to PS–3 power supply and switch S7 on test cable as shown by broken lines in figure 5–5.

(*c*) Turn PS–3 power supply on and adjust its front panel controls until the front panel meter indicates +150 volts dc.

(*d*) Set switch S7 on test cable to on position. Allow 15 minutes for warmup.

NOTE

In (*e*) through (*h*) below, Digital Voltmeter ME–231/FYQ–5 with dc multi-

function plug-in unit is used to measure the dc voltages.

(*e*) Using the digital voltmeter, connect leads between terminals 16 (–) and 17 (+) on module 7A5A4. The digital voltmeter should indicate +150 volts dc. If necessary, readjust PS–3 power supply front panel controls until digital voltmeter indicates +150 volts dc.

(*f*) Using the digital voltmeter, connect leads between terminals 16 (–) and 15 (+) on module 7A5A4. The digital voltmeter should indicate from +123 to +133 volts dc.

(*g*) Adjust front panel controls on PS–3 power supply until the front panel meter indicates +130 volts dc. The digital voltmeter should indicate from +123 to +133 volts dc.

(*h*) Adjust front panel controls on PS–3 power supply until front panel meter indicates +170 volts dc. The digital voltmeter should indicate from +123 to +133 volts dc.

(*i*) Set switch S7 on test cable to off position and turn PS–3 power supply to off position.

(*j*) Disconnect test setup.

b. Troubleshooting Chart. The troubleshooting chart for module 7A5 is divided into three parts, (1) through (3), corresponding to modules 7A5A2 through 7A5A4, respectively.

(1) *Module 7A5A2 Troubleshooting Chart.* Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* (2) above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3–2) wiring diagrams (figs. 5–6 and 5–7) and parts location diagram (fig. 5–33).

CAUTION

This equipment is transistorized. Use multimeter RX100 ohms range to measure circuit resistances, thereby preventing possible damage or destruction to transistors due to excessive current.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Multimeter does not indicate from +26.5 to +29.5 volts dc (step (*c*)).	Defective module 7A5 wiring	Check for continuity between pin C of module 7A5 connector and terminal 2 of module 7A5A2. Check for continuity between pin E of module 7A5 connector and terminal 5 of module 7A5A2. Repair or replace wiring if defective.
2	Multimeter does not indicate from +26.5 to +29.5 volts dc (step (*d*)).	Defective relay 7A5A2K2	Check relay and replace if defective.
3	Multimeter does not indicate from +26.5 to +29.5 volts dc (step (*e*)).	Defective relay 7A5A2K1	Check relay and replace if defective.
4	Multimeter does not indicate from +26.5 to +29.5 volts dc (step (*f*)).	*a.* Defective transistor(s) 7A5A2Q1 and/or 7A5A2Q2. *b.* Defective module 7A5 wiring	*a.* Check transistor(s) and replace if defective. *b.* Check for continuity between pin A of module 7A5 connector and terminal 1 of module 7A5A2. Check for continuity between pin L of module 7A5 connector and terminal 10 of module 7A5A2. Repair or replace wiring if defective.
5	Multimeter does not indicate –3.3 vdc (step (*i*)).	Defective module 7A5 wiring	Check for continuity between pin F of module 7A5 connector and terminal 6 of module 7A5A2. Check for continuity between pin M of module 7A5 connector and terminal 11 of module 7A5A2.
6	Multimeter does not indicate +4.7 vdc (step (*j*)).	Defective module 7A5 wiring	Check for continuity between pin K of module 7A5 connector and terminal 9 of module 7A5A2. Repair or replace wiring if defective.
7	Multimeter does not indicate from –2.8 to –3.8 volts dc (step (*k*)).	*a.* Defective resistor 7A5A2R11 *b.* Defective transistor 7A5A2Q6	*a.* Check resistor for 3,900 ± 195 ohms resistance. If necessary, replace defective resistor. *b.* Check transistor and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
8	Multimeter does not indicate from –2.8 to –3.8 volts dc (step (*l*)).	*a.* Defective resistor 7A5A2R13	*a.* Check resistor for 3,900 ± 195 ohms resistance. If necessary, replace defective resistor.
		b. Defective transistor 7A5A2Q7	*b.* Check transistor and replace if defective.
9	Multimeter does not indicate from +26.5 to +29.5 volts dc (step (*n*)).	Defective module 7A5 wiring	Check for continuity between pin D of module 7A5 connector and terminal 4 of module 7A5A2. Repair or replace wiring if defective.
10	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*o*)).	*a.* Defective resistor 7A5A2R12	*a.* Check resistor for 12K ± 600 ohms resistance. If necessary, replace defective resistor.
		b. Defective resistor 7A5A2R10	*b.* Check resistor for 1,500 ± 75 ohms resistance. If necessary, replace defective resistor.
		c. Defective transistor 7A5A2Q6	*c.* Check transistor and replace if defective.
11	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*p*)).	*a.* Defective resistor 7A5A2R10	*a.* Check resistor for 1,500 ± 75 ohms resistance. If necessary, replace defective resistor.
		b. Defective transistor 7A5A2Q6	*b.* Check transistor and replace if defective.
12	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*q*)).	*a.* Defective diode 7A5A2CR7	*a.* Check diode and replace if defective.
		b. Defective transistor 7A5A2Q5	*b.* Check transistor and replace if defective.
13	Multimeter does not indicate from +4.2 to +5.2 volts dc (step (*r*)).	*a.* Defective resistor 7A5A2R9	*a.* Check resistor for 2K ± 100 ohms resistance. If necessary, replace defective resistor.
		b. Defective transistor 7A5A2Q5	*b.* Check transistor and replace if defective.
		c. Defective transistor 7A5A2Q7	*c.* Check transistor and replace if defective.
		d. Defective quad gate 7A5A2Z1	*d.* Remove quad gate 7A5A2Z1 from module 7A5A2. Check for +4.7 ± 0.5 volts dc at collector of transistor 7A5A2Q5. If +4.7 ± 0.5 volts dc is not obtained, replace defective quad gate 7A5A2Z1.
		e. Defective flip-flop 7A5A2Z2	*e.* Remove flip-flop 7A5A2Z2 from module 7A5A2. Check for +4.7 ± 0.5 volts dc at collector of transistor 7A5A2Q5. If +4.7 ± 0.5 volts dc is not obtained, replace defective flip-flop 7A5A2Z2.
14	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*t*)).	*a.* Defective diode 7A5A2CR7	*a.* Check diode and replace if defective.
		b. Defective transistor 7A5A2Q5	*b.* Check transistor and replace if defective.
15	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*u*)).	Defective transistor 7A5A2Q5	Check transistor and replace if defective.
16	Multimeter does not indicate from +26.5 to 29.5 volt dc (step (*w*)).	Defective module 7A5 wiring	Check for continuity between pin J of module 7A5 connector and terminal 8 of module 7A5A2. Repair or replace wiring if defective.
17	Digital voltmeter does not indicate from –0.6 to +0.6 volt dc (step (*x*)).	*a.* Defective resistor 7A5A2R14	*a.* Check resistor for 12K ± 600 ohms resistance. If necessary, replace defective resistor.
		b. Defective transistor 7A5A2Q7	*b.* Check transistor and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
18	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*y*)).	Defective transistor 7A5A2Q7	Check transistor and replace if defective.
19	Multimeter does not indicate from +4.2 to +5.2 volts dc (step (*aa*)).	*a.* Defective resistor 7A5A2R8 *b.* Defective relay 7A5A2K2 *c.* Defective flip-flop 7A5A2Z2	*a.* Check resistor for 1K ± 50 ohms resistance. If necessary, replace defective resistor. *b.* Check for infinite resistance between contacts B2 and B3 of relay 7A5A2K2. If infinite resistance indication is not obtained, replace defective relay. *c.* Remove flip-flop 7A5A2Z2 from module 7A5A2. Check for +4.7 ± 0.5 volts dc at contact B2 of relay 7A5A2K2. If +4.7 ± 0.5 volts dc indication is obtained, replace defective flip-flop 7A5A2Z2.
20	Multimeter does not indicate from +4.2 to +5.2 volts dc (step (*ab*)).	Defective quad gate 7A5A2Z1 or flip-flop 7A5A2Z2.	Remove quad gate 7A5A2Z1 from module 7A5A2. Check for +4.7 ± 0.5 volts dc at terminal 9 of flip-flop 7A5A2Z2. If +4.7 ± 0.5 volts dc indication is obtained, replace defective quad gate 7A5A2Z1. If +4.7 ± 0.5 volts dc indication is not obtained replace defective flip-flop 7A5A2Z2.
21	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*ac*)).	Defective quad gate 7A5A2Z1 or flip-flop 7A5A2Z2.	Remove quad gate 7A5A2Z1 from module 7A5A2. Check for +0 ± 0.6 volt dc at terminal 6 of flip-flop 7A5A2Z2. If 0 ± 0.6 volt dc indication is obtained, replace defective quad gate 7A5A2Z1. If 0 ± 0.6 volt dc is not obtained, replace defective flip-flop 7A5A2Z2.
22	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*ad*)).	Defective quad gate 7A5A2Z1	Remove quad gate 7A5A2Z1 from module 7A5A2. Check for 0 ± 0.6 volt dc at cathode of diode 7A5A2CR1. If 0 ± 0.6 volt dc is obtained, replace defective quad gate 7A5A2Z1.
23	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*ae*)).	Defective diode 7A5A2CR1	Check diode and replace if defective.
24	Multimeter does not indicate from –0.6 to +0.6 volt dc.	*a.* Defective diode 7A5A2CR2 *b.* Defective transistor(s) 7A5A2Q1 and/or 7A5A2Q2.	*a.* Check diode and replace if defective. *b.* Check transistor(s) and replace if defective.
25	Multimeter does not indicate from +4.2 to +5.2 volt dc (step (*ah*)).	Defective quad gate 7A5A2Z1 or flip-flop 7A5A2Z2.	Remove quad gate 7A5A2Z1 from module 7A5A2. Check for +4.7 ± 0.5 volts dc at terminal 6 of flip-flop 7A5A2Z2. If +4.7 ± 0.5 volts dc indication is obtained, replace defective quad gate 7A5A2Z1. If +4.7 ± 0.5 volts dc indication is not obtained, replace defective flip-flop 7A5A2Z2.
26	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*ai*)).	Defective quad gate 7A5A2Z1 or flip-flop 7A5A2Z2.	Remove quad gate 7A5A2Z1 from module 7A5A2. Check for 0 ± 0.6 volt dc at terminal 9 of flip-flop 7A5A2Z2. If 0 ± 0.6 volt dc in-

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
			dication is obtained, replace defective quad gate 7A5A2Z1. If 0 ± 0.6 volt dc indication is not obtained, replace defective flip-flop 7A5A2Z2.
27	Oscilloscope does not display pulse train from 4.2 to 5.2 volts peak-to-peak at a frequency from 0.5 to 1.5 pulse-per-second (step (*aj*)).	*a.* Defective resistor(s) 7A5A2R2, 7A5A2R3, 7A5A2R4 and/or 7A5A2R5.	*a.* Check resistor 7A5A2R2 for 2,700 ± 135 ohms resistance, resistor 7A5A2R3 for 13K ± 650 ohms resistance, resistor 7A5A2R4 for 13K ± 650 ohms resistance and resistor 7A5A2R5 for 5,100 ± 255 ohms resistance. If necessary, replace defective resistor(s).
		b. Defective capacitor(s) 7A5A2C1 and/or 7A5A2C2.	*b.* Check capacitor(s) and replace if defective.
		c. Defective transistor(s) 7A5A2Q3 and/or 7A5A2Q4.	*c.* Check transistor(s) and replace if defective.
		d. Defective quad gate 7A5A2Z1	*d.* Remove quad gate 7A5A2Z1 from module 7A5A2. Check for desired pulse train at collector of transistor 7A5A2Q4. If desired pulse train is obtained, replace defective quad gate 7A5A2Z1.
28	Oscilloscope does not display pulse train from 4.2 to 5.2 volts peak-to-peak at a frequency from 0.5 to 1.5 pulse-per-second (step (*ak*).	Defective quad gate 7A5A2Z1	Same as item 27*d*.
29	Oscilloscope does not display pulse train of from 1 to 1.4 volt peak-to-peak at a frequency of from 0.5 to 1.5 pulse-per-second (step (*al*)).	*a.* Defective diode 7A5A2CR1	*a.* Check diode and replace if defective.
		b. Defective diode 7A5A2CR2	*b.* Check diode and replace if defective.
		c. Defective resistor 7A5A2R1	*c.* Check resistor for 1K ± 50 ohms resistance. If necessary, replace defective resistor.
		d. Defective transistor(s) 7A5A2Q1 and/or 7A5A2Q2.	*d.* Check transistor(s) and replace if defective.
30	Oscilloscope does not display pulse train from 26.5 to 29.5 volts peak-to-peak at a frequency from 0.5 to 1.5 pulse-per-second (step (*am*)).	Defective transistor(s) 7A5A2Q1 and/or 7A5A2Q2.	Check transistor(s) and replace if defective.
31	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*ao*)).	*a.* Defective 7A5A2CR6	*a.* Check diode and replace if defective.
		b. Defective diode 7A5A2CR4	*b.* Check diode and replace if defective.
		c. Defective relay 7A5A2K2	*c.* Check for proper operation of A and B set of contacts and for proper coil resistance on relay. If necessary, replace defective relay.
		d. Defective flip-flop 7A5A2Z2	*d.* Remove flip-flop 7A5A2Z2 from module 7A5A2. Check for 0 volt dc on contact B2 of relay 7A5A2. If 0 volt dc indication is obtained, replace defective flip-flop 7A5A2Z2.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		e. Defective module 7A5 wiring	*e.* Check for continuity between pin H of module 7A5 connector and terminal 7 of module 7A5A2. Repair or replace wiring.
32	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*ap*)).	Defective flip-flop 7A5A2Z2	Same as item 31*d*.
33	Multimeter does not indicate from +4.2 to +5.2 volts dc (step (*aq*)).	Defective flip-flop 7A5A2Z2	Same as item 31*d*.
34	Multimeter does not indicate from +4.1 to +5.3 volts dc (step (*ar*)).	Defective quad gate 7A5A2Z1	Check quad gate and replace if defective.
35	Multimeter does not indicate from +8.5 to +9.5 volts dc (step (*as*)).	*a.* Defective diode 7A5A2CR3	*a.* Check diode and replace if defective.
		b. Defective resistor 7A5A2R6	*b.* Check resistor for 220 ± 11 ohms resistance. If necessary, replace defective resistor.
36	Multimeter does not indicate from –0.6 to +0.6 volt dc (step (*at*)).	Defective relay 7A5A2K1	Disconnect one side of 7A5A2R7. Check for infinite resistance between contacts B1 and B2 of relay. If infinite resistance is not obtained, replace defective relay.
37	Multimeter does not indicate from +26.5 to +29.5 volts dc (step (*av*)).	Defective module 7A5 wiring	Check for continuity between pin B of module 7A5 connector and terminal 2 of module 7A5A2. Repair or replace wiring if defective.
38	Multimeter does not indicate from +9.0 to +10.0 volts dc (step (*aw*)).	*a.* Defective resistor 7A5A2R7	*a.* Check resistor for 240 ± 12 ohms resistance. If necessary, replace defective resistor.
		b. Defective diode 7A5A2CR5	*b.* Check diode and replace if defective.
		c. Defective relay 7A5A2K1	*c.* Check for proper operation of B set of contacts and for proper coil resistance of relay. If necessary, replace defective relay.

(2) *Module 7A5A3 troubleshooting chart.* Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* (3) above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3–2), wiring diagrams (figs. 5–6 and 5–8) and parts location diagram (fig. 5–34).

CAUTION

This equipment is transistorized. Use multimeter RX100 ohms range to measure circuit resistances, thereby preventing possible damage or destruction of transistors in 7A5A3AR1 due to excessive current.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Digital voltmeter does not indicate –24.0 volts dc (step *d*).	Defective module 7A5 wiring	Check for continuity between pin P of module 7A5 connector and terminal 13 of module 7A5A3. Check for continuity between pin K of module 7A5 connector and terminal 14 of module 7A5A3. Repair or replace wiring if defective.
2	Digital voltmeter does not indicate the minimum	*a.* Defective zener diode 7A5A3VR1	*a.* Check zener diode and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
	linear output voltage range from -4.0 to -6.0 volts dc (step *f*).	*b.* Defective resistor 7A5A3R1	*b.* Check resistor for 4220 ± 42 ohms resistance. If necessary, replace defective resistor.
		c. Defective potentiometer 7A5A3R2	*c.* Check potentiometer for 1000 ± 10 ohms resistance. If necessary, replace defective potentiometer.
		d. Defective resistor 7A5A3R3	*d.* Check resistor for 17,800 ± 178 ohms resistance. If necessary, replace defective resistor.
3	Digital voltmeter does not indicate -5.03 volts dc (step *h*).	Defective amplifier 7A5A3AR1	Remove amplifier 7A5A3AR1 from module 7A5A3. Check for -5.03 volts dc at terminal 12 of module 7A5A3. If -5.03 volts dc is obtained, replace defective amplifier 7A5A3AR1.
4	Digital voltmeter does not indicate -5.03 volts dc (step *i*).	Defective amplifier 7A5A3AR1	Remove amplifier 7A5A3AR1 from module 7A5A3. Check for -5.03 volts dc at terminal 12 of module 7A5A3. If -5.03 volts dc is obtained, replace defective amplifier 7A5A3AR1.

(3) *Module 7A5A4 troubleshooting chart.* Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* (4) above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3-2), wiring diagrams (figs. 5-6 and 5-9) and parts location diagram (fig. 5-35).

CAUTION

This equipment is transistorized. Use multimeter RX100 ohms range to measure circuit resistance thereby, preventing possible damage or destruction of transistors due to excessive current.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Digital voltmeter does not indicate +150 volts dc (step *e*).	Defective module 7A5 wiring	Check for continuity between pin U of module 7A5 connector and terminal 17 of module 7A5A4. Check for continuity between pin T of module 7A5 connector and terminal 16 of module 7A5A4. Repair or replace wiring if defective.
2	Digital voltmeter does not indicate from +123 to +133 volts dc (step *f*).	*a.* Defective Zener diode 7A5A4VR1	*a.* Check Zener diode and replace if defective.
		b. Defective Zener diode 7A5A4VR2	*b.* Check Zener diode and replace if defective.
		c. Defective transistor 7A5A4Q1	*c.* Check transistor and replace if defective.
		d. Defective regulator 7A5A4AR1	*d.* Check regulator and replace if defective.
		e. Defective resistor 7A5A4R6	*e.* Check resistor for 10 ± 1 ohms resistance. If necessary, replace defective resistor.
		f. Defective resistor 7A5A4R5	*f.* Check resistor for 200 ± 10 ohms resistance. If necessary, replace defective resistor.
3	Digital voltmeter does not indicate from +123 to +133 volts dc (step *g*).	Defective regulator 7A5A4AR1	Check regulator and replace if defective.
4	Digital voltmeter does not indicate from +123 to +133 volts dc (step *h*).	Defective regulator 7A5A4AR1	Check regulator and replace if defective.

c. Voltage and Resistance (V & R) Measure-ents.

(1) *Voltage measurements.* Voltage meas-rements for module 7A5 are divided into three ırts, (*a*) through (*c*), corresponding to mod-es 7A5A2 through 7A5A4, respectively.

(*a*) *Module 7A5A2 voltage measure-ents.* To perform voltage measurements on anual V/H control panel module 7A5A2, pro-ed as follows:

NOTE

Remove cover and module 7A5 from manual V/H control panel.

WARNING

Make sure that PS-1 and PS-2 supplies and +28-volt dc power source are off be-fore performing steps *1* through *3* below. Dangerous voltages of +28 volt dc are present at terminals when power source is on.

1. Connect the connector J1 on test ɔle (fig. 5-5) to connector on module 7A5.

NOTE

Switch S7 on test cable is not used.

2. Set switches S1 through S6 on test cable to their off positions.

3. Connect test cable (fig. 5-5) to +28 vdc power source and PS-1 and PS-2 power supplies.

4. Turn +28 vdc power source on.

5. Turn PS-1 power supply on and ad-just its front panel controls until the front panel meter indicates -3.3 volts dc.

6. Turn PS-2 power supply on and ad-just its front panel controls until the front panel meter indicates +4.7 volts dc. Allow 15 minutes for warmup.

NOTE

All voltage measurements for module 7A5A2 are listed for the first set test cable switch positions. For the rest of the test cable switch positions, only voltage measurements that change as the result different test cable switch positions are given.

7. Using the multimeter (vdc ranges) or oscilloscope (pulsating dc voltages), perform the voltage measurements on terminals of module 7A5A2 and its components as indicated below.

Multimeter		Range	Switch setting on test cable (fig. 5-5)						Voltage (vdc)
+	-		S1	S2	S3	S4	S5	S6	
7A5A2-1	7A5A2-10	2.5 vdc	on	on	off	on	off	off	0.0
5A2Q1-E	7A5A2-3	2.5 vdc							0.0
5A2Q1-B	7A5A2-3	2.5 vdc							0.0
5A2Q1-C	7A5A2-3	50 vdc							+26.5 to +29.5
5A2Q2-E	7A5A2-3	2.5 vdc							0.0
5A2Q2-B	7A5A2-3	2.5 vdc							0.0
A2Q2-C	7A5A2-3	50 vdc							+26.5 to +29.5
A2Q3-E	7A5A2-3	2.5 vdc							0.0
A2Q3-B	7A5A2-3								Pulsating +4.7 ±0.5[a]
A2Q3-C	7A5A2-3								Pulsating +4.7 ±0.5[a]
A2Q4-E	7A5A2-3	2.5 vdc							0.0
A2Q4-B	7A5A2-3								Pulsating +4.7 ±0.5[a]
A2Q4-C	7A5A2-3								Pulsating +4.7 ±0.5[a]
A2Q5-E	7A5A2-3	2.5 vdc							0.0
A2Q5-B	7A5A2-3	2.5 vdc							0.0
A2Q5-C	7A5A2-3	10 vdc							+4.2 to +5.2
A2Q6-E	7A5A2-3	2.5 vdc							0.0
A2Q6-B	7A5A2-3	2.5 vdc							0.0 to +0.6
A2Q6-C	7A5A2-3	2.5 vdc							0.0 to +0.6
A2Q7-E	7A5A2-3	2.5 vdc							0.0
A2Q7-B	7A5A2-3	10 vdc							-2.7 to -3.9
A2Q7-C	7A5A2-3	10 vdc							+4.2 to +5.2
A2K1-B1	7A5A2-3	50 vdc							+26.5 to +29.5
A2K1-B2	7A5A2-3	50 vdc							+26.5 to +29.5
A2K1-B3	7A5A2-3	50 vdc							+26.5 to +29.5
A2K1-X1	7A5A2K1-X2	2.5 vdc							0.0
A2K2-A1	7A5A2-3	2.5 vdc							0.0
A2K2-A2	7A5A2-3	50 vdc							+26.5 to +29.5
A2K2-A3	7A5A2-3	50 vdc							+26.5 to +29.5

Multimeter +	Multimeter −	Range	Switch setting on test cable (fig. 5-5) S1	S2	S3	S4	S5	S6	Voltage (vdc)
7A5A2K2-B1	7A5A2-3	2.5 vdc							0.0
7A5A2K2-B2	7A5A2-3	10 vdc							+4.2 to +4.7
7A5A2K2-X2	7A5A2K2-X1	2.5 vdc							0.0
7A5A2Z	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z1-2	7A5A2-3								Pulsating +4.7 ±0.5[a]
7A5A2Z1-3	7A5A2-3	2.5 vdc							0.0 to 0.6
7A5A2Z1-4	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z1-6	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z1-7	7A5A2-3	2.5 vdc							0.0
7A5A2Z1-8	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z1-9	7A5A2-3	10 vdc							+4.2 to +5.2
8A5A2Z1-11	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z1-12	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z1-14	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z2-2	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z2-3	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z2-4	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z2-5	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z2-6	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z2-7	7A5A2-3	2.5 vdc							0.0
7A5A2Z2-9	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z2-11	7A5A2-3	2.5 vdc							0.0
7A5A2Z2-14	7A5A2-3	10 vdc							+4 .2 to +5.2
7A5A2-1	7A5A2-10		on	on	off	on	off	on	Pulsating +28 ±1.5[a]
7A5A2Q1-E	7A5A2-3								Pulsating +0.3 ±0.3[a]
7A5A2Q1-B	7A5A2-3								Pulsating +4.7 ±0.5[a]
7A5A2Q1-C	7A5A2-3								Pulsating +28 ±1.5[a]
7A5A2Q2-B	7A5A2-3								Pulsating +0.3 ±0.3[a]
7A5A2Q2-C	7A5A2-3								Pulsating +28 ±1.5[a]
7A5A2Q5-C	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Q7-B	7A5A2-3	50 vdc							+26.5 to +29.5
7A5A2Q7-C	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2K1-B1	7A5A2-3								Pulsating +28 ±1.5[a]
7A5A2K1-B2	7A5A2-3								Pulsating +28 ±1.5[a]
7A5A2K1-B3	7A5A2-3								Pulsating +28 ±1.5[a]
7A5A2Z1-1	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z1-3	7A5A2-3								Pulsating +4.7 ±0.5[a]
7A5A2Z1-4	7A5A2-3								Pulsating +4.7 ±0.5[a]
7A5A2Z1-6	7A5A2-3								Pulsating +4.7 ±0.5[a]
7A5A2Z1-8	7A5A2-3								Pulsating +4.7 ±0.5[a]
7A5A2Z1-9	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z1-11	7A5A2-3								Pulsating +4.7 ±0.5[a]
7A5A2Z1-12	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z2-2	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Z2-6	7A5A2-3	10 vdc							+4.2 to +5.2
7A5A2Z2-9	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Q5-B	7A5A2-3	2.5 vdc	on	on	off	off	off	off	0.0 to +0.6
7A5A2Q6-B	7A5A2-3	10 vdc							-2.7 to -3.9
7A5A2Q6-C	7A5A2-3	2.5 vdc							+0.6 to +1.2
7A5A2Q7-B	7A5A2-3	10 vdc							-2.7 to -3.9
7A5A2-1	7A5A2-10	50 vdc	on	on	off	off	on[b]	off	+17.0 to +21.0
7A5A2Q1-E	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Q1-B	7A5A2-3	2.5 vdc							+0.6 to +1.2
7A5A2Q1-C	7A5A2-3	2.5 vdc							0.6 to +1.2
7A5A2Q2-B	7A5A2-3	2.5 vdc							0.0 to +0.6
7A5A2Q2-C	7A5A2-3	2.5 vdc							+0.6 to +1.2
7A5A2K1-B1	7A5A2-3	50 vdc							+17.0 to +21.0
7A5A2K1-B2	7A5A2-3	50 vdc							+17.0 to +21.0
7A5A2K1-B3	7A5A2-3	50 vdc							+17.0 to +21.0
7A5A2K2-A1	7A5A2-3	50 vdc							+26.5 to +29.5
7A5A2K2-A3	7A5A2-3	50 vdc							+17.0 to +21.0
7A5A2K2-B2	7A5A2-3	2.5 vdc							0.0

Multimeter		Range	Switch setting on test cable (fig. 5-5)						Voltage (vdc)
+	–		S1	S2	S3	S4	S5	S6	
A5A2K2–X1	7A5A2K2–X2	50 vdc							+26.5 to +29.5
A5A2Z1–1	7A5A2–3	2.5 vdc							0.0 to +0.6
A5A2Z1–3	7A5A2–3	2.5 vdc							0.0 to +0.6
A5A2Z1–4	7A5A2–3	2.5 vdc							0.0 to +0.6
A5A2Z1–6	7A5A2–3	10 vdc							+4.2 to +5.2
A5A2Z1–8	7A5A2–3	10 vdc							+4.2 to +5.2
A5A2Z1–11	7A5A2–3	2.5 vdc							0.0 to 0.6
A5A2Z1–12	7A5A2–3	10 vdc							+4.2 to +5.2
A5A2Z2–5	7A5A2–3	2.5 vdc							0.0
A5A2Z2–6	7A5A2–3	2.5 vdc							0.0 to +0.6
A5A2Z2–9	7A5A2–3	10 vdc							+4.2 to +5.2
7A5A2–1	7A5A2–10	50 vdc	on	on	on	off	off	off	+7.0 to +12.0
A5A2K1–B3	7A5A2–3	50 vdc							+7.0 to +12.0
A5A2K1–X1	7A5A2–X2	50 vdc							+26.5 to +29.5

[a] Pulsating dc voltages may be measured using an oscilloscope.
[b] When test cable switch S5 is listed in the on position, set all other test cable switches to correct position. Then, momentarily set switch S5 n test cable to on and then set switch S5 to off before measuring listed voltages.

(*b*) *Module 7A5A3 voltage measurements.*

NOTE

The voltage measurements of module 7A5A3 requires the use of PS-3 power supply, switch S7, and resistor R1 on the test cable (fig. 5-5). The PS-3 power supply, switch S7 and connections used for module 7A5A3 are shown in solid lines in figure 5-5.

o perform voltage measurement on manual V/H ntrol panel module 7A5A3, proceed as follows:

NOTE

Remove cover and module 7A5 from manual V/H control panel.

WARNING

Make sure that PS-3 power supply is off before performing steps *1* through *3* below. Dangerous voltages of +250 volt dc are present at terminals when power source is on.

1. Connect the connector J1 on test ble (fig. 5-5) to connector on module 7A5.

2. Set switches S1 through S7 on test ble to their off positions.

3. Connect test cable (fig. 5-5) to PS-3 wer supply.

4. Turn PS-3 power supply on and adst its front panel controls until the front panel eter indicates –24 volts dc.

5. Set switch S7 on test cable to on poion. Allow 15 minutes for warmup.

6. Using the multimeter, perform the ltage measurements on terminals of module 5A3 and its components as indicated below.

Multimeter		Range	Voltage (vdc)
+	–		
7A5A3–14	7A5A3–12	10 vdc	–4.0 to –6.0 vdc
7A5A3–14	7A5A3AR1–1		
7A5A3–14	7A5A3AR1–2		
7A5A3–14	7A5A3AR1–3		
7A5A3–14	7A5A3AR1–4	50 vdc	–19.0 to –29.0 vdc
7A5A3–14	7A5A3AR1–5		
7A5A3–14	7A5A3AR1–6	10 vdc	–4.0 to –6.0 vdc
7A5A3–14	7A5A3AR1–7	2.5 vdc	0.0 vdc
7A5A3–14	7A5A3AR1–8		

(*c*) *Module 7A5A4 voltage measurements.*

NOTE

The voltage measurements of module 7A5A4 requires the use of PS-3 power supply switch S7 and resistor R2. The PS-3 power supply, switch S7 and connections used for module 7A5A4 are shown in broken lines in figure 5-5.

To perform voltage measurements on manual V/H control panel module 7A5A4, proceed as follows:

NOTE

Remove cover and module 7A5 from manual V/H control panel.

WARNING

Make sure that PS-3 power supply is off before performing steps *1* through *3* below. Dangerous voltages of +250 volt dc are present at terminals when power source is on.

1. Connect the connector J1 on test cable (fig. 5-5) to connector on module 7A5.

2. Set switches S1 through S7 on test cable to their off positions.

3. Connect test cable (fig. 5-5) to PS-3 power supply and switch S7 as shown by broken lines.

4. Turn PS-3 power supply on and adjust its front panel control until the front panel meter indicates +150 volts dc.

5. Set switch S7 on test cable to on position. Allow 15 minutes for warmup.

6. Using the multimeter, perform the voltage measurements on terminals of module 7A5A4 and its components as indicated below.

Multimeter +	Multimeter −	Range	Voltage (vdc)
7A5A4-15	7A5A4-16	250 vdc	+123.0 to +133.0 vdc
7A5A4AR1-1	7A5A4-16	250 vdc	+123.0 to +133.0 vdc
7A5A4AR1-2	7A5A4-16		
7A5A4AR1-3	7A5A4-16		
7A5A4AR1-4	7A5A4-16		
7A5A4AR1-5	7A5A4-16	250 vdc	+123.0 to +133.0 vdc
7A5A4AR1-6	7A5A4-16		
7A5A4AR1-7	7A5A4-16		
7A5A4AR1-8	7A5A4-16		
7A5A4AR1-9	7A5A4-16		
7A5A4AR1-10	7A5A4-16		
7A5A4Q1-E	7A5A4-16		
7A5A4Q1-B	7A5A4-16		
7A5A4Q1-B	7A5A4-16	250 vdc	+130.0 to +170.0 vdc

(2) *Resistance measurements.* Not applicable.

5-8. Photo Junction Panel (Unit 8) Troubleshooting

The troubleshooting procedures to be performed by general support maintenance are identical with the troubleshooting procedures performed by direct support maintenance (para 3-6).

5-9. Photo Control Panel (Unit 3) Troubleshooting

General support troubleshooting procedures for the photo control panel are given below.

a. Operational Check.

(1) Connect the photo control panel and LS-78A as shown in test setup (fig. 5-10).

NOTE

Refer to figure 5-11 for location of controls and indicators on LS-78A.

(2) Turn on ac and dc power sources. Set MASTER switch to CONTROL PANEL position and all other switches on LS-78A to their OFF, neutral, or counterclockwise positions.

(3) Set switches on photo control panel a follows:

(*a*) SYS PWR switch 3S4 to OFF positio

(*b*) V/H switch 3S1 to AUTO positio

(*c*) MOUNT switch 3S2 to 90° positio

(*d*) MODE switch 3S3 to AUTO pos tion.

(*e*) FRAMES REMAINING counter 100.

(4) Set POWER switch (PANEL POWE section) on LS-78A to ON position. The D POWER and AC POWER indicators (PANE POWER section) on LS-78A should light, a edge panel lamps on photo control panel shou light. Allow 15 minutes for warmup.

(5) Momentarily depress OPERATE inc cator 3DS1 on photo control panel. The OPE ATE indicator 3DS1 should light while d pressed.

(6) Momentarily depress READY indciat 3DS2 on photo control panel. The READY i dicator 3DS2 should light while depressed.

(7) Set SYS PWR switch 3S4 on photo co trol panel to READY position. The AUTO a 90° indicators (CONTROL PANEL section) LS-78A should light. The READY indicat 3DS2 on photo control panel should light.

(8) Set SYS PWR switch 3S4 on photo co trol panel to OPERATE position. The OPERAT indicator (CONTROL PANEL section) on L 78A should light. The READY indicator 3D on photo control panel remains lit and OPERAT indicator 3DS1 on photo control panel remai off.

(9) Set MOUNT switch 3S2 on photo co trol panel to L15° position. The 90° indicat (CONTROL PANEL section) on LS-78A shou go out. The 15°L indicator (CONTROL PANE section) on LS-78A should light.

(10) Set MOUNT switch 3S2 on photo co trol panel to L30° position. The 15°L indicat (CONTROL PANEL section) on LS-78A shou go out. The 30°L indicator (CONTROL PANE section) on LS-78A should light.

(11) Set MOUNT switch 3S2 on photo co trol panel to R30° position. The 30°L indicat (CONTROL PANEL section) on LS-78A shou go out. The 30°R indicator (CONTROL PANE section) on LS-78A should light.

(12) Set MOUNT switch 3S2 on photo co trol panel to R15° position. The 30°R indicat (CONTROL PANEL section) on LS-78A shou go out. The 15°R indicator (CONTROL PANE section) on LS-78A should light.

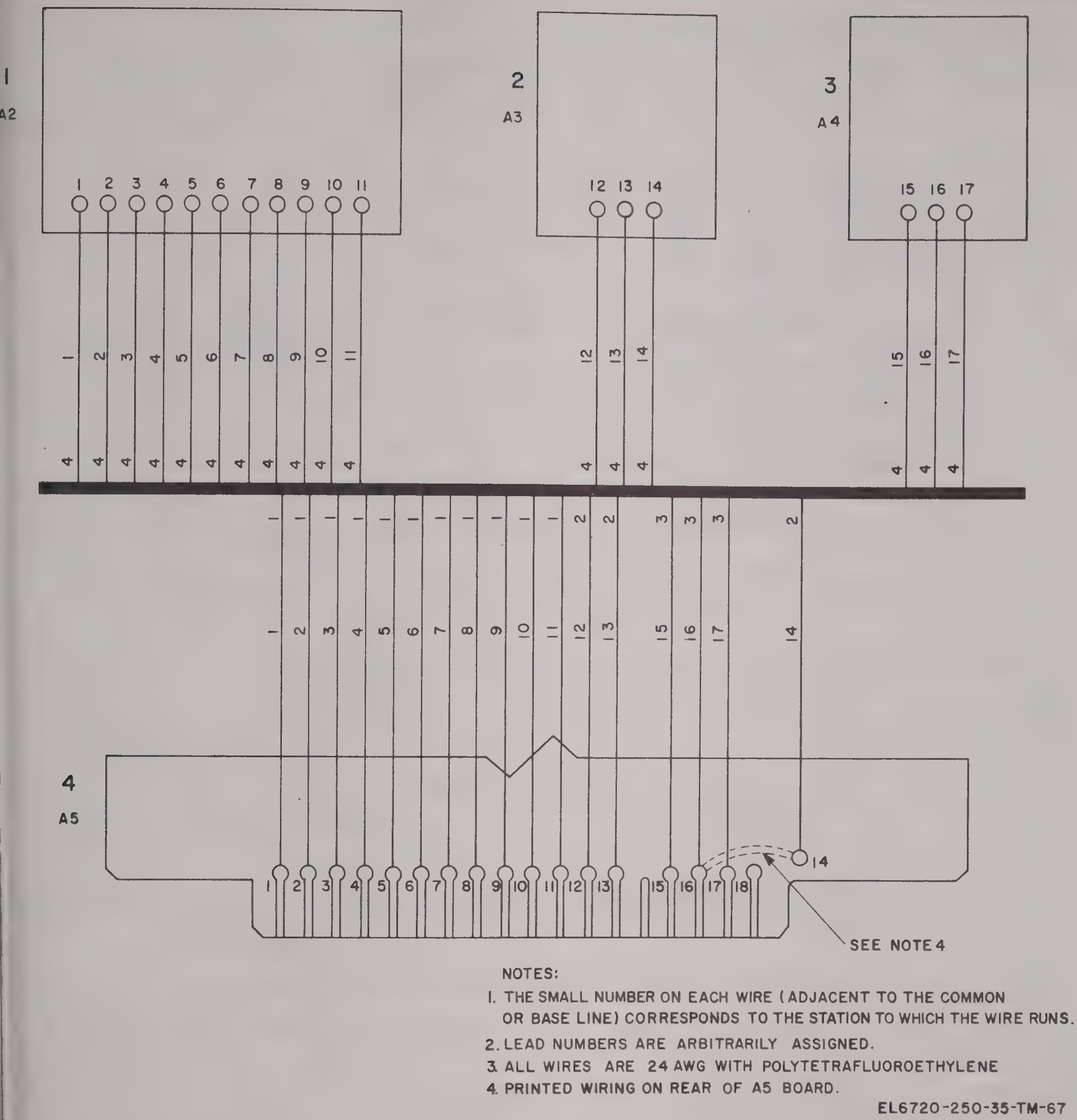


Figure 5-6. Manual V/H control panel module 7A5, wiring diagram.

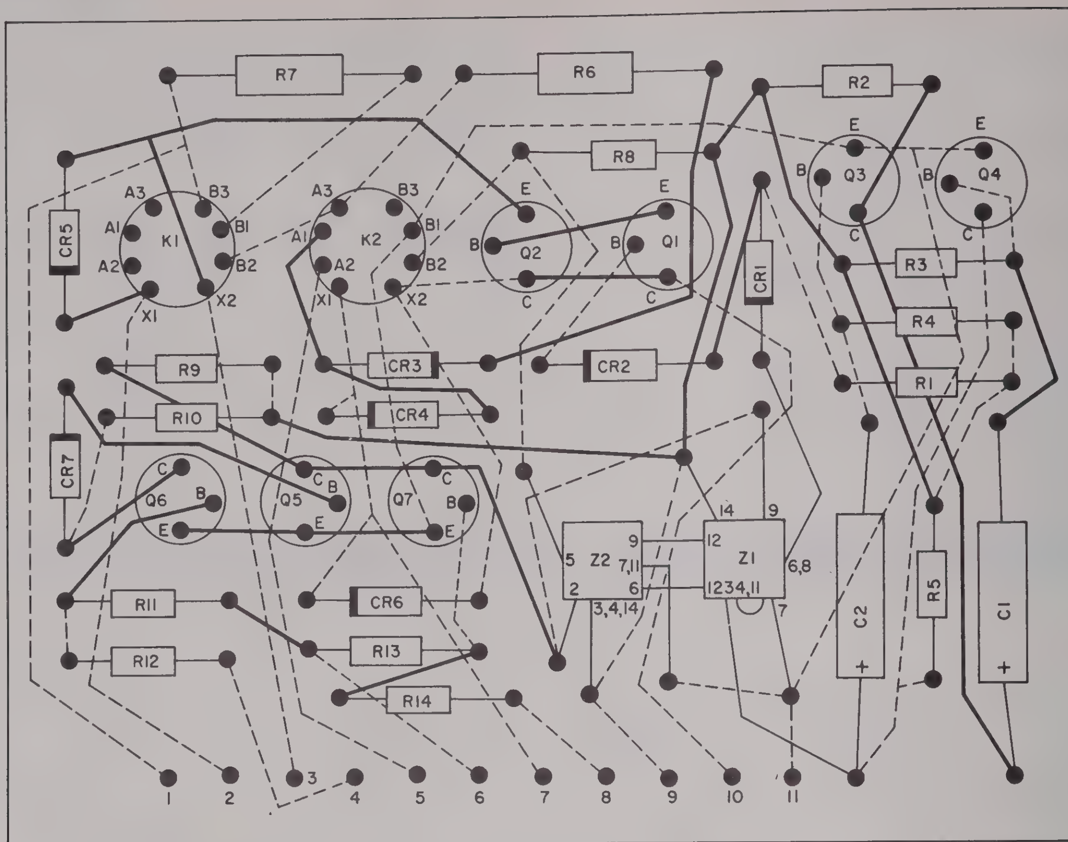
(13) Set MOUNT switch 3S2 on photo con- panel to 90° position. The 15°R indicator)NTROL PANEL section) on LS-78A should out. The 90° indicator (CONTROL PANEL ion) on LS-78A should light.

(14) Set MODE switch 3S3 on photo control el to PULSE position. The AUTO indicator)NTROL PANEL section) on LS-78A should out. The PULSE indicator (CONTROL NEL section) on LS-78A should light. The LSE IMC indicator (CONTROL PANEL sec-) on LS-78A should remain off.

(15) Set MODE switch 3S3 on photo control el to PULSE IMC position. The PULSE indicator (CONTROL PANEL section) on LS-78A should remain on. The PULSE IMC indicator (CONTROL PANEL section) on LS-78A should light.

(16) Set MODE switch 3S3 on photo control panel to NIGHT position. The PULSE and PULSE IMC indicators (CONTROL PANEL section) on LS-78A should go out. The NIGHT indicator (CONTROL PANEL section) on LS-78A should light.

(17) Set MODE switch 3S3 on photo control panel to AUTO position. The NIGHT indicator (CONTROL PANEL section) on LS-78A should



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. - - - - - WIRING ON BACK OF BOARD.
4. ━━━ WIRING ON FRONT OF BOARD.
5. LOCATING DOT ON ASSEMBLIES Z1 & Z2 IDENTIFY PIN 1.
6. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO.7 AND ASSEMBLY NO. A5A2 (7A5A2).

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Figure 5-7. Manual V/H control panel module 1A5A2, wiring diagram.

go out. The AUTO indicator (CONTROL PANEL section) on LS-78A should light.

(18) Depress and hold OPERATE switch (CONTROL PANEL section) on LS-78A. The OPERATE indicator 3DS1 on photo control panel should light. The FRAMES REMAINING counter 3M1 on photo control panel should indicate 099.

(19) Release OPERATE switch (CONTROL PANEL section) on LS-78A. The OPERATE indicator 3DS1 on photo control panel should go out.

(20) Using multimeter on the +50 vdc range, connect leads between VOLTMETER + and VOLTMETER − terminals (INSTRUMENTATION section) on LS-78A.

(21) Set TEST switch (CONTROL PANEL section) on LS-78A to E V/H position. The multimeter should indicate 0 volt dc.

(22) Set V/H switch 3S1 on photo contr panel to MANUAL position. The multimet should indicate from +26.5 to +29.5 volts dc.

(23) Set V/H switch 3S1 on photo contr panel to AUTO position. The multimeter shou indicate 0 volt dc.

(24) Set TEST switch (CONTROL PANE section) on LS-78A to OFF. Disconnect multi eter from LS-78A.

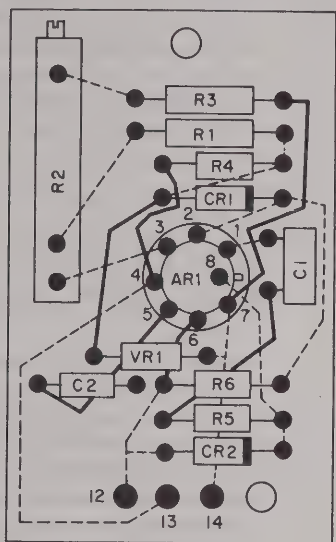
(25) Set SYS PWR switch 3S4 on photo co trol panel to OFF position. The READY in cator 3DS2 on photo control panel should go o The OPERATE, 90°, and AUTO indicato (CONTROL PANEL section) on LS-78A shou go out.

(26) Set POWER switch (PANEL POWE section) on LS-78A to OFF position. The I POWER and AC POWER indicators (PANE POWER section) on LS-78A should go out.

(27) Turn ac and dc power sources off.

(28) Disconnect test setup.

ɔ. *Troubleshooting Chart.* Steps referenced in *Trouble symptom* column refer to numbered paragraphs in the operation check (*a* above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3–7) and wiring diagram (fig. 3–8).



NOTES:
1. CIRCUITS VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ---- WIRING ON BACK OF BOARD.
4. ▬▬ WIRING ON FRONT OF BOARD.
5. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO.7 AND ASSEMBLY NO. A5A3 (7A5A3).

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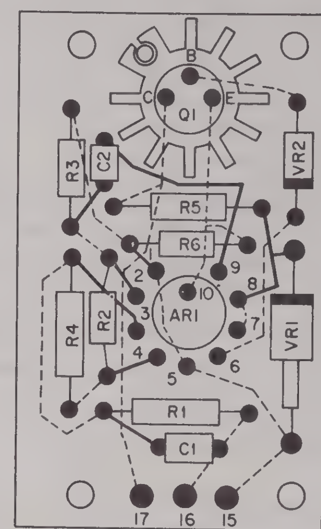
Figure 5–8. Manual V/H control panel module 7A5A3, wiring diagram.



NOTES:
1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ---- WIRING ON BACK OF BOARD.
4. ▬▬ WIRING ON FRONT OF BOARD.
5. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO.7 AND ASSY NO.A5A3 (7A5A3).

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Figure 5–9. Manual V/H control panel module 7A5A4, wiring diagram.

No.	Trouble symptom	Probable cause	Checks and corrective measures
	Both front panel edge lamps do not light (step 4).	*a.* Defective choke 3L1	*a.* Check choke for 0.05 to 0.1 ohm resistance. If necessary replace defective choke.
		b. Defective wiring	*b.* Check for continuity between pin A of connector 3J1 and choke 3L1 input. Check for continuity between output of choke 3L1 and ground terminal on connector 3J2. Check for continuity between pin L of connector 3J1 and center conductor on connector 3J2. Repair or replace wiring if defective.
		c. Defective front panel edge lamp(s)	*c.* Check edge lamp(s). If necessary, replace front panel.
	One front panel edge lamp does not light (step 4).	Defective front panel edge lamp	Check edge lamp. If necessary, replace front panel.
	OPERATE indicator 3DS1 does not light (step 5).	*a.* Defective OPERATE lamp 3DS1	*a.* Check lamp and replace if defective.
		b. Defective OPERATE lampholder 3XDS1.	*b.* Check lampholder and replace if defective.
		c. Defective filter 3FL1	*c.* Check filter for 3 to 4 ohms resistance. If necessary, replace defective filter.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		d. Defective wiring	*d.* Check for continuity between output of choke 3L1 and input of filter 3FL1. Check for continuity between output of filter 3FL1 and terminal 1 on lampholder 3XDS1. Check for continuity between pin R of connector 3J1 and terminal 3 on lampholder 3XDS1. Repair or replace wiring if defective.
4	OPERATE indicator 3DS1 does not go out (step 5).	Defective OPERATE lampholder 3XDS1.	Check lampholder and replace if defective.
5	READY indicator 3DS2 does not light (step 6).	*a.* Defective READY lamp 3DS2	*a.* Check lamp and replace if defective.
		b. Defective READY lamp holder 3XDS2.	*b.* Check lampholder and replace if defective.
		c. Defective wiring	*c.* Check for continuity between output of choke 3L1 and terminal 1 on lampholder 3XDS2. Check for continuity between pin R of connector 3J1 and terminal 3 on lampholder 3XDS2. Repair or replace wiring if defective.
6	READY indicator 3DS2 does not go out (step 6).	Defective lamp holder 3XDS2	Check lampholder and replace if defective.
7	AUTO and 90° indicators on LS-78A do not light (step 7).	*a.* Defective SYS PWR switch 3S4	*a.* Check switch and replace if defective.
		b. Defective wiring	*b.* Check for continuity between output of choke 3L1 and contact 5 on SYS PWR switch 3S4. Check for continuity between contact 6 on SYS PWR switch 3S4 and pin V of connector 3J1. Repair or replace wiring if defective.
8	AUTO indicator on LS-78A does not light (step 7).	Defective MODE switch 3S3	Check switch and replace if defective.
9	90° indicator on LS-78A does not light (step 7).	Defective MOUNT switch 3S2	Check switch and replace if defective.
10	READY indicator 3DS2 does not light (step 7).	*a.* Defective READY lamp 3DS2	*a.* Momentarily depress READY indicator. If READY indicator does not light while depressed, replace defective lamp.
		b. Defective READY lampholder 3XDS2.	*b.* Check lampholder and replace if defective.
		c. Defective wiring	*c.* Check for continuity between pin G of connector 3J1 and terminal 2 on lamp holder 3XDS2. Repair or replace wiring if defective.
11	OPERATE indicator on LS-78A does not light (step 8).	*a.* Defective SYS PWR switch 3S4	*a.* Check switch and replace if defective.
		b. Defective wiring	*b.* Check for continuity between contacts 2 and 5 on switch 3S4. Check for continuity between pin V of connector 3J1 and contact 3 on switch 3S4. Repair or replace wiring if defective.
12	READY indicator 3DS2 does not remain lit (step 8).	Defective SYS PWR switch 3S4	Check switch and replace if defective.

em No.	Trouble symptom	Probable cause	Checks and corrective measures
3	90° indicator on LS-78A does not go out (step 9).	Defective MOUNT switch 3S2	Check switch and replace if defective.
4	15°L indicator on LS-78A does not light (step 9).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between pin S of connector 3J1 and contact R on switch 3S2. Check for continuity between contact 1 on MOUNT switch 3S2 and pin *a* of connector 3J1. Repair or replace wiring if defective.
5	15°L indicator on LS-78A does not go out (step 10).	Defective MOUNT switch 3S2	Check switch and replace if defective.
6	30°L indicator on LS-78A does not light (step 10).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between pin *b* of connector 3J1 and contact 2 on MOUNT switch 3S2. Repair or replace wiring if defective.
7	30°L indicator on LS-78A does not go out (step 11).	Defective MOUNT switch 3S2	Check switch and replace if defective.
8	30°R indicator on LS-78A does not light (step 11).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between pin C of connector 3J1 and contact 4 on MOUNT switch 3S2. Repair or replace wiring if defective.
9	30°R indicator on LS-78A does not go out (step 12).	Defective MOUNT switch 3S2	Check switch and replace if defective.
0	15°R indicator on LS-78A does not light (step 12).	*a.* Defective MOUNT switch 3S2 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between pin *d* of connector 3J1 and contact 5 on MOUNT switch 3S2. Repair or replace wiring if defective.
1	15°R indicator on LS-78A does not go out and 90° indicator on LS-78A does not light (step 13).	Defective MOUNT switch 3S2	Check switch and replace if defective.
2	AUTO indicator on LS-78A does not go out (step 14).	Defective MODE switch 3S3	Check switch and replace if defective.
3	PULSE indicator on LS-78A does not light (step 14).	*a.* Defective MODE switch 3S3 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between output choke 3L1 and contact R on MODE switch 3S3. Check for continuity between contact 2 on MODE switch 3S3 and pin P of connector 3J1. Repair or replace wiring if defective.
	PULSE IMC indicator on LS-78A does not remain off (step 14).	*a.* Defective diode 3CR2 *b.* Defective MODE switch 3S3	*a.* Check diode and replace if defective. *b.* Check switch and replace if defective.
	PULSE indicator on LS-78A does not light (step 15).	Defective diode 3CR2	Check diode and replace if defective.
	PULSE IMC indicator on LS-78A does not light (step 15).	*a.* Defective MODE switch 3S3 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between contact 3 on MODE switch 3S3 and pin B of connector 3J1. Repair or replace wiring if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
27	PULSE and PULSE IMC indicators on LS-78A do not go out (step 16).	Defective MODE switch 3S2	Check switch and replace if defective.
28	NIGHT indicator on LS-78A does not light (step 16).	*a.* Defective MODE switch 3S3 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between contact 4 on MODE switch 3S3 and pin N of connector 3J1. Repair or replace wiring if defective.
29	NIGHT indicator on LS-78A does not go out and AUTO indicator on LS-78A does not light (step 17).	Defective MODE switch 3S3	Check switch and replace if defective.
30	OPERATE indicator 3DS1 does not light (step 18).	*a.* Defective OPERATE lamp 3DS1 *b.* Defective OPERATE lampholder 3XDS1. *c.* Defective diode 3CR1 *d.* Defective FRAMES REMAINING counter 3M1. *e.* Defective wiring	*a.* Momentarily depress OPERATE indicator. If OPERATE indicator does not light while depressed, replace defective lamp. *b.* Check lampholder and replace if defective. *c.* Check diode and replace if defective. *d.* Check counter and replace if defective. *e.* Check for continuity between pin K of connector 3J1 and terminal 2 on OPERATE lampholder 3XDS1. Repair or replace if defective.
31	FRAMES REMAINING counter 3M1 does not indicate 099 (step 18).	*a.* Defective FRAMES REMAINING counter 3M1. *b.* Defective wiring	*a.* Check counter and replace if defective. *b.* Check for continuity between pin *d* of connector 3J1 and positive terminal on FRAME REMAINING counter 3M1. Check for continuity between output terminal of filter 3FL1 and negative terminal on FRAMES REMAINING counter 3M1. Repair or replace wiring if defective.
32	OPERATE indicator 3DS1 does not go out (step 19).	Defective OPERATE lampholder 3XDS1.	Check lampholder and replace if defective.
33	Multimeter does not indicate 0 volt dc (step 21).	Defective V/H switch 3S1	Check switch and replace if defective.
34	Multimeter does not indicate from +26.5 to +29.5 volts dc (step 22).	*a.* Defective V/H switch 3S1 *b.* Defective wiring	*a.* Check switch and replace if defective. *b.* Check for continuity between pin M of connector 3J1 and arm of V/H switch 3S1. Check for continuity between pin H of connector 3J1 and contact (MANUAL) on V/H switch 3S1. Repair or replace wiring if defective.
35	Multimeter does not indicate 0 volt dc (step 23).	Defective V/H switch 3S1	Check switch and replace if defective.
36	READY indicator 3DS2 and OPERATE, 90° and AUTO indicators on LS-78A do not go out (step 25).	Defective SYS PWR switch 3S4	Check switch and replace if defective.

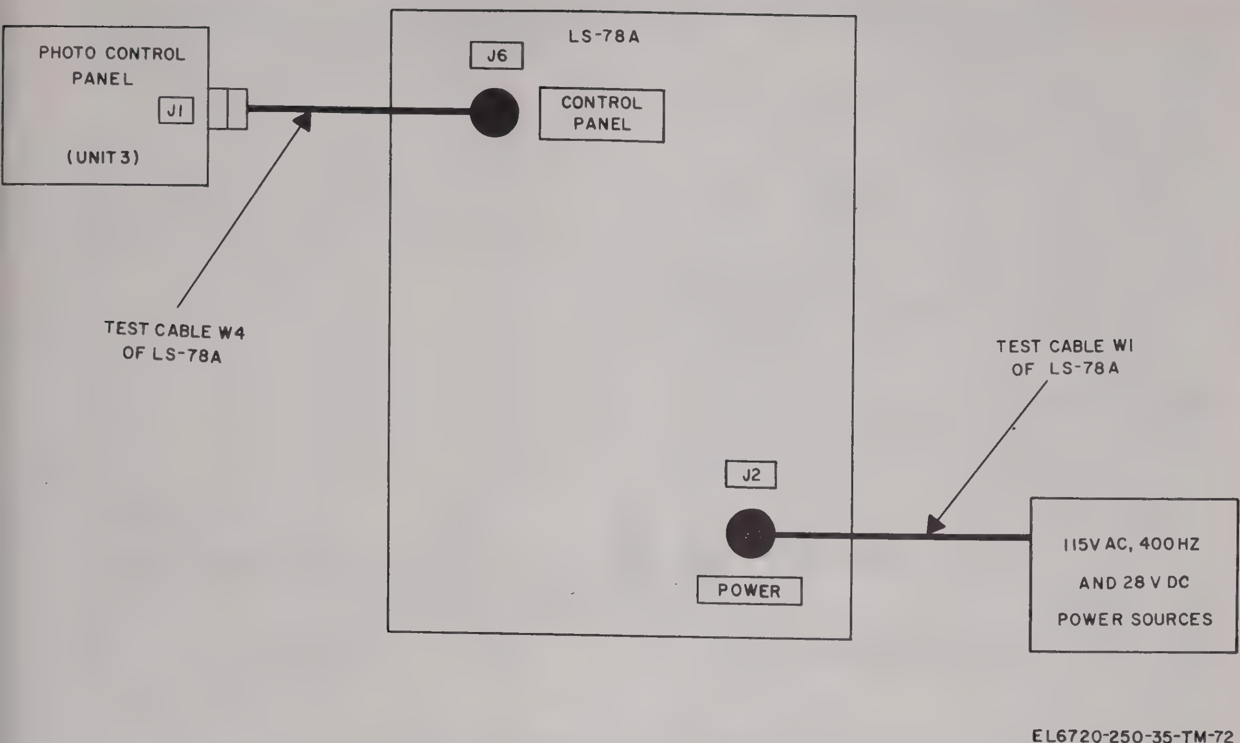


Figure 5-10. Photo control panel, test setup.

igure 5-11. LS-78A controls, indicators, and connectors.
[Located in back of manual]

. *Voltage and Resistance (V & R) Measments.* The V & R measurements to be permed by general support maintenance are iden-l with the V & R measurements performed by ect support maintenance (para 3-7*c*).

0. Photo System Assembly (Unit 1) Troubleshooting

eral support troubleshooting procedures for photo system assembly are given below.

Operational Check.

(1) Connect the photo system assembly, test pment and LS-80A as shown in test setup . 5-12). Use Digital Voltmeter ME-218/ I-64 in test setup.

NOTE

Refer to figure 5-13 for location of controls and indicators on LS-80A.

(2) Set switches and control on LS-80A as ws:

(*a*) MASTER switch (MASTER section) ONTROL PWR SUPPLY position.

(*b*) CONFIGURATION switch (CON-L-POWER SUPPLY section) to 44MM T position.

(*c*) E V/H 0-50 VOLTS control (CONTROL-POWER SUPPLY section) to 25.

(*d*) TEST switch (CONTROL-POWER SUPPLY section) to SYSTEM RDY GRD OFF position.

(*e*) All other switches to their OFF, neutral or counterclockwise positions.

(3) Turn ac and dc power sources on. Set POWER switch (PANEL POWER section) on LS-80A to ON position. The AC PWR and DC PWR indicators (PANEL POWER section), and MOUNT AC indicator (CONTROL-POWER SUPPLY section) on LS-80A should light. Allow 15 minutes for warmup.

(4) Set TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to SYSTEM RDY GRD ON position. The CAM 28V, AC ØA, AC ØB and VERT POS indicators (CONTROL-POWER SUPPLY section) on LS-80A should light. The INTVL PULSE indicator (CONTROL-POWER SUPPLY section) on LS-80A flashes.

(5) Set TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to SYSTEM OPERATE position. The SYS RDY indicator (CONTROL-POWER SUPPLY section), and DC VOLTS, SCOPE, COUNTER WIDTH and COUNTER INTVL indicators (MASTER section) on LS-80A should light. The MOUNT AC indicator (CONTROL-POWER SUPPLY section)

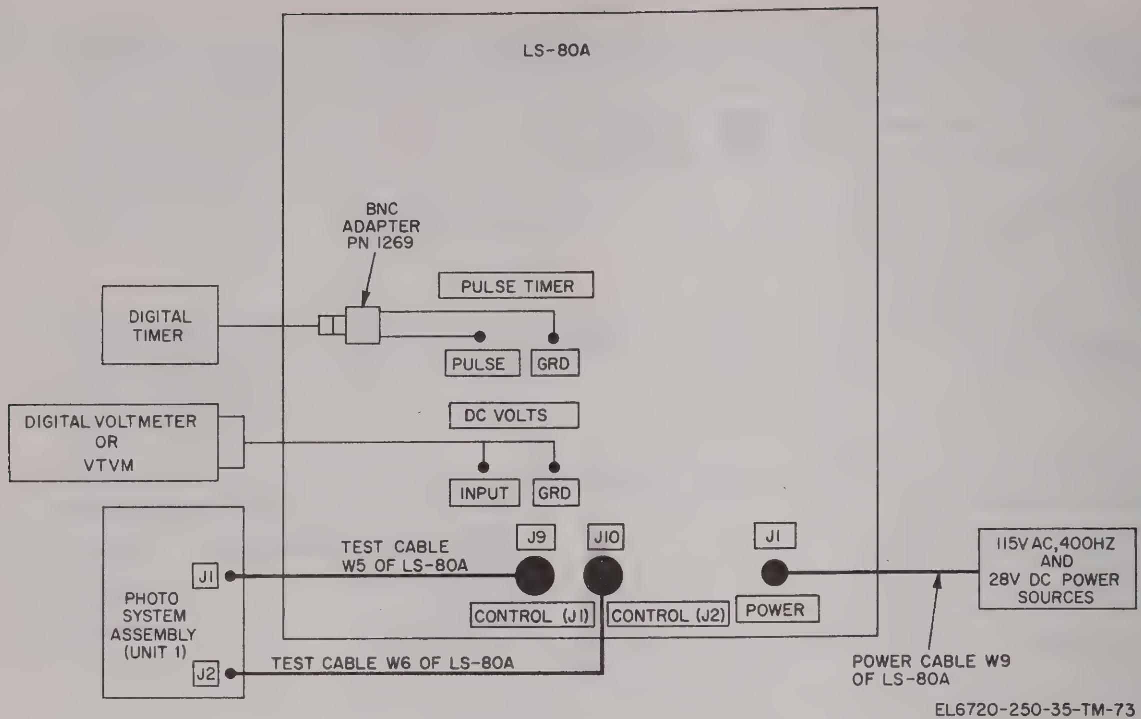


Figure 5-12. Photo system assembly, test setup.

Figure 5-13. LS-80A controls, indicators, and connectors. **[Located in back of manual]**

on LS-80A goes out. The INTVL PULSE indicator (CONTROL-POWER SUPPLY section) on LS-80A flashes at slower rate.

(6) Set CONFIGURATION switch (CONTROL-POWER SUPPLY section) on LS-80A to the position indicated in the following table. Refer to the result/indication column for indicators (CONTROL-POWER SUPPLY section) on LS-80A that are expected to light for each positioning of the CONFIGURATION switch.

CONFIGURATION switch settings	*Result/indication*
44MM VERT	VERT POS indicator should light.
3 IN. 15°R	RELAY OPR and MOUNT AC indicators should light. VERT POS indicator should go out.
3 IN. 30°R	RELAY OPR and MOUNT AC indicators should light.
3 IN. VERT	VERT POS and MOUNT AC indicators should light. RELAY OPR indicator should go out.
6 IN. 15°L	RELAY OPR and MOUNT AC indicators should light. VERT POS indicator should go out.
6 IN. 30°L	RELAY OPR and MOUNT AC indicators should light.
6 IN. VERT	VERT POS and MOUNT AC indicators should light. RELAY OPR indicator should go out.
12 IN. 15°L	RELAY OPR and MOUNT AC indicators should light. VERT POS indicator should go out.
12 IN. 30°L	RELAY OPR and MOUNT AC indicators should light.
12 IN. VERT	VERT POS indicators should light. RELAY OPR indicator should go out.

(7) Set CONFIGURATION switch and V/H 0-50 VOLTS control (CONTROL-POWE SUPPLY section) on LS-80A to the positions the following table. Refer to the result/indic tion column for indications on digital voltmet and digital timer that are expected for each po tion of the CONFIGURATION switch and V/H 0-50 VOLTS control.

CONFIGURATION switch settings	E V/H 0-50 VOLTS control settings		Result/indication
		Digital voltmeter (vdc)	*Digital timer (sec)*
44MM VERT	10	– 9.66 to –10.68	1.144 to 1.33
3 IN. 15°R	20	– 6.60 to – 7.30	1.67 to 1.95
3 IN. 30°R	35	– 8.37 to – 9.25	1.321 to 1.536
3 IN. VERT	50	–16.74 to –18.50	0.66 to 0.768
6 IN. 15°L	25	– 9.23 to –10.20	1.198 to 1.393
6 IN. 30°L	0.5	–14.20 to –15.70	0.778 to 0.905
6 IN. VERT	1.0	– 1.338 to – 1.48	Not required
6 IN. VERT	5.0	– 2.678 to – 2.96	Not required
6 IN. VERT	10	– 6.69 to – 7.40	Not required
6 IN. VERT	25	–13.38 to –14.80	Not required
6 IN. VERT	42	–26.78 to –29.60	0.413 to 0.480
6 IN. VERT	10	–46.86 to –51.80	Not required
6 IN. VERT	None	–66.95 to –74.00	Not required
12 IN. 15°L	25	–18.92 to –20.91	0.599 to 0.699
12 IN. 30°L	25	Not required	19.47 to 22.63
12 IN. 30°L	25	Not required	9.73 to 11.31
12 IN. 30°L	25	Not required	1.947 to 2.263
12 IN. 30°L	25	Not required	0.973 to 1.131
12 IN. 30°L	25	–29.11 to –32.18	0.3894 to 0.4525
12 IN. 30°L	1.0	Not required	0.232 to 0.269
12 IN. VERT	2.0	–26.78 to –29.6	0.413 to 0.480
44MM VERT	5.0	Not required	Not required

NOTE

Replace digital voltmeter with vtvm in test setup (fig. 5–12).

(8) Depress the OPERATE OFF switch (CONTROL-POWER SUPPLY section) on LS–80A. The INTVL PULSE indicator (CONTROL-POWER SUPPLY section) on LS–80A stops flashing and SYS RDY indicator (CONTROL-POWER SUPPLY section) on LS–80A goes out. No indications on vtvm and digital timer.

(9) Set E V/H 0–50 VOLTS control (CONTROL-POWER SUPPLY section) on LS–80A to 50.

(10) Depress PLUS OUTPUT switch (CONTROL-POWER SUPPLY section) on LS–80A. Using the vtvm, indication should be greater than 3 volts dc.

(11) Set TEST switch (CONTROL-POWER SUPPLY section) on LS–80A to SYSTEM MAN PIC position. The MOUNT AC, INTVL PULSE, and MAN PIC indicators (CONTROL-POWER SUPPLY section) and DC VOLTS indicator (MASTER section) on LS–80A should light. The SCOPE, COUNTER WIDTH and COUNTER INTVL indicators (MASTER section) on LS–80A should go out.

(12) Depress PLUS OUTPUT switch (CONTROL-POWER SUPPLY section) on LS–80A. The vtvm should indicate from +25 to +31 volts dc.

(13) Set TEST switch (CONTROL-POWER SUPPLY section) on LS–80A to SYSTEM NIGHT FLASH position. The NIGHT EXP, FLASH AC, and FLASH DC indicators (CONTROL-POWER supply section) on LS–80A should light. The MAN PIC indicator (CONTROL-POWER SUPPLY section) on LS–80A goes out. The INTVL PULSE indicator (CONTROL-POWER SUPPLY section) on LS–80A flashes.

(14) Set TEST switch (CONTROL-POWER SUPPLY section) on LS–80A to SYSTEM FLASH RDY position. The SYS RDY indicator (CONTROL-POWER SUPPLY section) on LS–80A should light.

(15) Set POWER switch (PANEL POWER section) on LS–80A to OFF position. All indicators should go out.

(16) Turn ac and dc power sources off.

(17) Disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a*, above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3–10) and wiring diagram (fig. 3–14).

NOTE

If either intervalometer module 1A1 or film drive amplifier module 1A2 is replaced, the adjustment procedures in

paragraph 5-55*b*(1) through (4) must be performed.

CAUTION

This equipment is transistorized. Use multimeter RX100 range to measure circuit resistances, thereby preventing possible damage or destruction to transistors due to excessive current.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	MOUNT AC indicator on LS-80A does not light (step 3).	*a.* Defective fuse 1F5	*a.* Check continuity of fuse and replace if defective.
		b. Defective filter 1FL4	*b.* Check filter for approx 0.2 ohm resistance. If necessary, replace defective filter.
		c. Defective diode 1A3CR7	*c.* Check diode and replace if defective.
		d. Defective LA-370A (1 3/4 inch) relay 1A3K7.	*d.* Check relay and replace if defective.
		e. Defective wiring	*e.* Check continuity of wiring. Repair or replace wiring if defective.
2	INTVL PULSE indicator on LS-80A does not flash (step 4).	*a.* Intervalometer module 1A1 not installed properly.	*a.* Insure intervalometer is properly seated.
		b. Defective filter 1FL5	*b.* Check filter for approx 0.01 ohm resistance. If necessary, replace defective filter.
		c. Defective intervalometer module 1A1.	*c.* Replace or check intervalometer module (para 5-11).
		d. Defective manual picture relay 1K7.	*d.* Check relay and replace if defective.
		e. Defective wiring	*e.* Check continuity of wiring. Repair or replace wiring if defective.
3	VERT POS indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 44MM VERT position (step 6).	Defective wiring	Check continuity of wiring. Repair or replace wiring if defective.
4	MOUNT AC indicator on LS-80A does not light in remaining setting (3 IN. 15°R through 12 IN. VERT) of CONFIGURATION switch on LS-80A (step 6).	*a.* Defective printed circuit board and component assembly module 1A3.	*a.* Replace or check printed circuit board and component assembly module (para 5-13).
		b. Defective wiring	*b.* Check continuity of wiring. Repair or replace wiring if defective.
5	Digital voltmeter indications are not within tolerance for various setting of CONFIGURATION switch on LS-80A and E V/H 0-50 VOLTS control on LS-80A (step 7).	*a.* Defective film drive amplifier module 1A2.	*a.* Replace or check film drive amplifier module (para 5-12).
		b. Defective wiring	*b.* Check continuity of wiring. Repair or replace wiring if defective.
6	Digital timer indications are not within tolerance for various setting of CONFIGURATION switch on LS-80A and E V/H 0-50 VOLTS control on LS-80A (step 7).	*a.* Defective intervalometer module 1A1.	*a.* Replace or check intervalometer module (para 5-11).
		b. Defective wiring	*b.* Check continuity of wiring. Repair or replace wiring if defective.
7	Vtvm is not greater than 3 volts dc (step 10).	*a.* Defective film drive amplifier module 1A2.	*a.* Replace or check film drive amplifier module (para 5-12).
		b. Defective wiring	*b.* Check continuity of wiring. Repair or replace wiring if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
8	MOUNT AC, DC VOLTS, INTVL PULSE, and MAN PIC indicators on LS-80A do not light (step 11).	*a.* Defective manual picture relay 1K7. *b.* Defective wiring	*a.* Check relay and replace if defective. *b.* Check continuity of wiring. Repair or replace wiring if defective.
9	Vtvm indication does not indicate from +25 to +31 volts dc (step 12).	*a.* Defective film drive amplifier module 1A2. *b.* Defective wiring	*a.* Repair or check film drive amplifier module (para 5-12). *b.* Check continuity of wiring. Repair or replace wiring if defective.
10	NIGHT EXP, FLASH AC, FLASH DC indicators on LS-80A do not light and INTVL PULSE indicator on LS-80A does not flash (step 13).	*a.* Defective night relay 1K4 *b.* Defective interlock relay 1K3 *c.* Defective ready relay 1K5 *d.* Defective wiring	*a.* Check relay and replace if defective. *b.* Check relay and replace if defective. *c.* Check relay and replace if defective. *d.* Check continuity of wiring. Repair or replace wiring if defective.
11	SYS RDY indicator on LS-80A does not light.	*a.* Defective flash interlock relay 1K6 *b.* Defective wiring	*a.* Check relay and replace if defective. *b.* Check continuity of wiring. Repair or replace wiring if defective.

c. Voltage and Resistance (V & R) Measurements.

(1) *Voltage measurements.* To perform voltage measurements on photo system assembly, proceed as follows:

(*a*) Connect the photo system assembly and LS-80A as shown in figure 5-12. Do not connect the digital timer, oscilloscope, or vtvm.

(*b*) Set switches and controls on LS-80A as follows:

1. MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

2. CONFIGURATION switch (CONTROL-POWER SUPPLY section) to 44MM VERT position.

3. E V/H 0-50 VOLTS control (CONTROL-POWER SUPPLY section) to 25.

4. TEST switch (CONTROL-POWER SUPPLY section) to SYSTEM RDY GRD OFF position.

5. POWER switch (PANEL POWER section) to ON position. Allow 15 minutes for warmup.

6. All other switches to their OFF, neutral or counterclockwise positions.

NOTE

For additional voltage measurements on the photo system assembly, refer to paragraph 3-8*c* (1).

(*c*) Using the multimeter, perform the voltage measurements on pins of test connector J3 as indicated below.

Multimeter			Voltage
+	−	Range	
A	AA	50 vdc	0 vdc
B	AA	50 vdc	+26.5 to +29.5 vdc
C	AA	250 vdc	108 to 118 vac
D	AA	250 vdc	108 to 118 vac
E	AA	250 vdc	108 to 118 vac
L	AA	50 vdc	+26.5 to +29.5 vdc
N	AA		
P	AA	50 vdc	+26.5 to +29.5 vdc
R	AA		
S	AA		
U	AA	50 vdc	+24 to +26 vdc
Y	AA		
W	AA		
X	AA		
Z	AA		
BB			
CC			
DD	AA	50 vdc	+26.5 to +29.5 vdc
GG			
HH			
a			
d			
e			
f			
h			
m			
m			
p			
r			
s			
t			
u			
v			
w			
x			

NOTE

For additional resistance measurements on photo system assembly, refer to paragraph 3-8*c*(2).

(2) *Resistance measurements.* Note that this equipment is transistorized. The resistance measurements in the following chart are obtained with no power applied to the photo system assembly and with no external connections to connectors 1J1 and 1J2. Using the multimeter, perform the resistance measurements on pins of test connector 1J3 as indicated in sample below.

Multimeter		Range	Resistance (ohms)
+	−		

5-11. Photo System Assembly (Unit 1) Intervalometer Module 1A1 Troubleshooting

General support troubleshooting procedures for the photo system assembly intervalometer module 1A1 are given below.

a. Operational Check.

(1) Insert intervalometer module 1A1 into INTERVALOMETER connector J2 of module test adapter.

(2) Connect plug tip of connector TP1 (adjacent to INTERVALOMETER connector J2) on module test adapter to test point TP1 on intervalometer module 1A1.

(3) Connect plug tip of connector TP2 (adjacent to INTERVALOMETER connector J2) on module test adapter to test point TP2 on intervalometer module 1A1.

(4) Connect plug tip of connector TP3 (adjacent to INTERVALOMETER connector J2) on module test adapter to test point TP3 on intervalometer module 1A1.

(5) Connect clip (adjacent to TP1 connector) on module test adapter to junction of 1A1C2 and 1A1CR4 on intervalometer module 1A1.

NOTE

Do not connect R C bridge in this test setup (fig. 5-14).

(6) Connect module test adapter, test equipment and LS-80A as shown in test setup (fig. 5-14). Use vtvm in test setup. Turn ac and dc power sources on.

NOTE

Refer to figure 5-13 for location of controls and indicators on LS-80A.

(7) Set switches and controls on LS-80A as follows:

(*a*) MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

(*b*) E V/H 0-50 VOLTS control (CONTROL-POWER SUPPLY section) to 25.

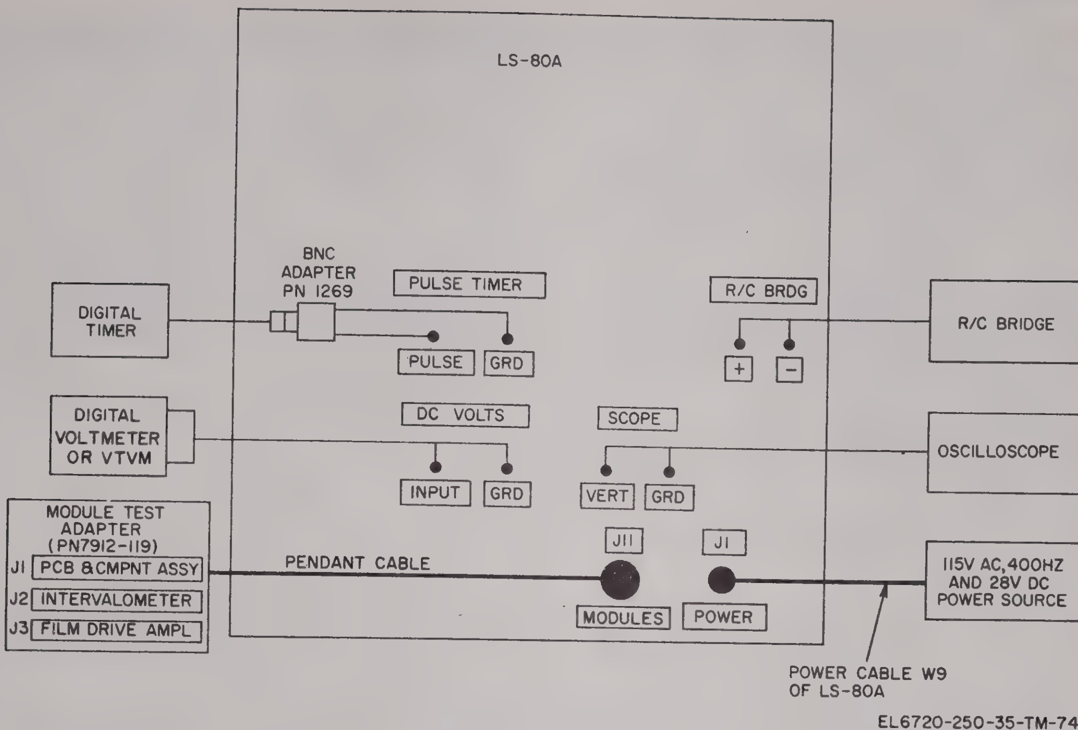


Figure 5-14. Photo system assembly modules, test setup.

(*c*) POWER switch (PANEL POWER ection) to ON position. Allow 15 minutes to varmup.

(*d*) All other switches and controls to heir OFF, neutral or counterclockwise positions.

(8) Adjust the digital timer to measure inerval as follows:

(*a*) Start switch to +.

(*b*) Stop switch to –.

(9) Set MODULE TEST switch (CONROL-POWER SUPPLY section) on LS-80A to NTVL OPR position. The MAN PIC and IODULE INTVL indicators (CONTROL-POWER SUPPLY section), and SCOPE, OUNTER INTVL, COUNTER WIDTH indicaors (MASTER section) on LS-80A should light. 'he INTERNAL PULSE indicator. CONTROL-POWER SUPPLY section) on LS-80A flashes. 'he digital timer should indicate a pulse width rom 65 to 115 ms. The oscilloscope waveform hould be as shown in figure 5-15.

(10) Set stop switch on digital timer to + osition. The digital timer should indicate a ulse interval from 389.4 to 452.2 ms.

(11) Set E V/H 0-50 VOLTS control (CONROL-POWER SUPPLY section) on LS-80A to 2.0. The digital timer should indicate a pulse aterval from 232 to 269 ms.

(12) Set E V/H 0-50 VOLTS control (CONROL-POWER SUPPLY section) on LS-80A to The digital timer should indicate a pulse aterval from 1.947 to 2.263 seconds.

(13) Set E V/H 0-50 VOLTS control (CONTROL-POWER SUPPLY section) on LS-80A to 0.5. The digital timer should indicate a pulse interval from 19.47 to 22.63 seconds.

(14) Set E V/H 0-50 VOLTS control (CONTROL POWER SUPPLY section) on LS-80A to 25. The digital timer should indicate a pulse interval from 389.4 to 452.5ms.

(15) Set stop switch on digital timer to – position. The digital timer should indicate a pulse width from 65 to 115 ms.

(16) Depress OPERATE OFF switch (CONTROL-POWER SUPPLY section) on LS-80A. The INTERVAL PULSE indicator (CONTROL-POWER SUPPLY section) on LS-80A should stop flashing.

(17) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to INTVL R9 BAL position. The vtvm should indicate from –1 to +1 volt dc.

(18) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) to INTVL R7 BAL position, and depress OPERATE OFF switch (CONTROL-POWER SUPPLY section) on LS-80A. The vtvm should indicate from –1 to +1 volt dc.

(19) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to INTVL +40VDC position. The vtvm should indicate from +34 to +40 volts dc. The oscilloscope

waveform should be less than 0.2 volt peak-to-peak.

(20) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to INTVL -40VDC position. The vtvm should indicate from -34 to -40 volts dc. The oscilloscope waveform should be less than 0.2 volt peak-to-peak.

(21) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to INTVL TP3 position. The oscilloscope waveform should be as shown in figure 5-15.

(22) Set POWER switch (PANEL POWER section) on LS-80A to OFF position. All indicators should go out.

(23) Turn ac and dc power sources off.

(24) Disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts and associated circuitry referenced on the troubleshooting chart are shown in the schematic diagram (fig. 3-12, wiring diagram (fig. 5-16), and parts location diagram (fig. 5-38).

CAUTION

This equipment is transistorized. Use multimeter RX100 ohms range to measure circuit resistances, thereby preventing possible damage or destruction to transistors due to excessive current.

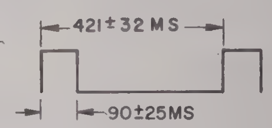


Figure 5-15. Intervalometer module 1A1 waveform.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	COUNTER WIDTH, COUNTER INTVL, SCOPE and MODULE INTVL indicators on LS-80A do not light (step 9).	*a.* Defective thermistor 1A1A1RT1	*a.* Check for 10 to 70 ohms resistance between terminals 4 and 7 of operational amplifier assembly 1A1A1. If proper indication cannot be obtained, replace defective operational amplifier assembly.
		b. Defective wiring	*b.* Repair or replace wiring if defective.
2	INTERVAL PULSE indicator on LS-80A does not flash (step 9).	*a.* Defective transistor(s) 1A1Q1 through 1A1Q6.	*a.* Check transistor(s) and replace if defective.
		b. Defective threshold detector diode 1A1CR13.	*b.* Check diode and replace if defective.
		c. Defective operate relay 1A1K1	*c.* Check for continuity between emitter load of transistors 1A1Q4 and 1A1Q5 and replace relay if multimeter does not indicate continuity. Check coil of relay for 495 to 677 ohms resistance, and replace if defective.
		d. Defective capacitor 1A1C6	*d.* Check capacitor and replace if defective.
		e. Defective operational amplifier assembly 1A1A1.	*e.* Check operational amplifier assembly as follows: (1) Check for -6.2 ±0.5 volts dc between terminals 3 (-) and 2 (+). (2) Check for +25 ±1 volts dc between terminals 1 (+) and 2 (-). (3) Check for +6.2 ±0.5 volts dc between terminals 6 (+) and 2 (-). (4) Check for +28 ±1.5 volts dc between terminals 4 (+) and 7 (-). (5) Check for 0 ±1 volt dc between terminals 5 (+) and 2 (-). If 0 ±1 volt dc is not

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
			obtained and other voltages ((1) through (4), above) are obtained, replace defective operational amplifier assembly.
3	Digital timer does not indicate a pulse width from 65 to 115 ms and oscilloscope waveform is abnormal (step 9).	*a.* Defective transistor(s) 1A1Q1 through 1A1Q6.	*a.* Check transistor(s) and replace if defective.
		b. Defective threshold detector 1A1CR13.	*b.* Check diode and replace if defective.
		c. Defective operate relay 1A1K1	*c.* Check for continuity between emitter load of transistors 1A1Q4 and 1A1Q5 and replace relay if multimeter does not indicate continuity. Check coil of relay for 495 to 677 ohm resistance, and replace if defective.
		d. Defective operational amplifier assembly 1A1A1.	*d.* Same as item 2*e*.
4	Digital timer does not indicate a pulse interval from 232 to 269 ms (step 11).	*a.* Defective transistor(s) 1A1Q1 through 1A1Q6.	*a.* Check transistor(s) and replace if defective.
		b. Defective threshold detector diode 1A1CR13.	*b.* Check diode and replace if defective.
		c. Defective operate relay 1A1K1	*c.* Check for continuity between emitter load of transistors 1A1Q4 and 1A1Q5 and replace relay if multimeter does not indicate continuity. Check coil of relay for 495 to 677 ohm resistance and replace if defective.
		d. Defective operational amplifier assembly 1A1A1.	*d.* Same as item 2*e*.
5	Digital timer does not indicate a pulse interval from 1.947 to 2.263 seconds (step 12).	*a.* Defective transistors 1A1Q1 through 1A1Q6.	*a.* Check transistor(s) and replace if defective.
		b. Defective threshold detector diode 1A1CR13.	*b.* Check diode and replace if defective.
		c. Defective operate relay 1A1K1	*c.* Check for continuity between emitter load of transistors 1A1Q4 and 1A1Q5 and replace relay if multimeter does not indicate continuity. Check coil of relay for 495 to 677 ohms resistance, and replace if defective.
		d. Defective operational amplifier assembly 1A1A1.	*d.* Same as item 2*e*.
6	Digital timer does not indicate a pulse interval from 19.47 to 22.63 seconds (step 13).	*a.* Defective transistor(s) 1A1Q1 through 1A1Q6.	*a.* Check transistor(s) and replace if defective.
		b. Defective threshold detector diode 1A1CR13.	*b.* Check diode and replace if defective.
		c. Defective operate relay 1A1K1	*c.* Check for continuity between emitter load of transistors 1A1Q4 and 1A1Q5 and replace relay if multimeter does not indicate continuity. Check coil of relay for 495 to 677 ohms resistance, and replace if defective.
		d. Defective operational amplifier assembly 1A1A1.	*d.* Same as item 2*e*.
7	Digital timer does not indicate a pulse interval from 389.4 to 452.5 ms (step 14).	*a.* Defective transistor(s) 1A1Q1 through 1A1Q6.	*a.* Check transistor(s) and replace if defective.
		b. Defective threshold detector diode 1A1CR13.	*b.* Check diode and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		c. Defective operate relay 1A1K1	*c.* Check for continuity between emitter load of transistors 1A1Q4 and 1A1Q5 and replace relay if multimeter does not indicate continuity. Check coil of relay for 495 to 677 ohms resistance, and replace if defective.
		d. Defective operational amplifier assembly 1A1A1.	*d.* Same as item 2*e*.
8	INTERVAL PULSE indicator on LS-80A continues to flash (step 16).	Defective operate relay 1A1K1	Check coil of relay for 495 to 677 ohms resistance, and replace if defective.
9	Vtvm does not indicate from −1 to +1 volt dc (step 17).	*a.* Variable resistor 1A1A1R9 not properly adjusted.	*a.* Adjust variable resistor as directed in paragraph 5-55*b*(1).
		b. Defective operational amplifier assembly 1A1A1.	*b.* Same as item 2*e*.
10	Vtvm does not indicate from −1 to +1 volt dc (step 18).	*a.* Variable resistor 1A1A1R7 not properly adjusted.	*a.* Adjust variable resistor as directed in paragraph 5-55*b*(2).
		b. Defective operational amplifier assembly 1A1A1.	*b.* Same as item 2*e*.
11	Vtvm does not indicate from +34 to +40 volts dc and oscilloscope waveform is not less than 0.2 volt peak-to-peak (step 19).	*a.* Defective Zener diode 1A1CR1	*a.* Check diode and replace if defective.
		b. Defective diode 1A1CR1	*b.* Check diode and replace if defective.
		c. Defective filter capacitor 1A1C1	*c.* Check capacitor and replace if defective.
		d. Defective current limiting resistor 1A1R1.	*d.* Check resistor for 8K ± 80 ohms resistance. If necessary, replace defective resistor.
		e. Defective wiring	*e.* Repair or replace defective wiring.
12	Vtvm does not indicate −34 to −40 volts dc and oscilloscope waveform is not less than 0.2 volt peak-to-peak (step 20).	*a.* Defective Zener diode 1A1CR7	*a.* Check diode and replace if defective.
		b. Defective diode(s) 1A1CR12 and/or 1A1CR10.	*b.* Check diode(s) and replace if defective.
		c. Defective filter capacitor 1A1C5	*c.* Check capacitor and replace if defective.
		d. Defective current limiting resistor 1A1R20.	*d.* Check resistor for 5K ±50 ohms resistance. If necessary, replace defective resistor.
		e. Defective wiring	*e.* Repair or replace wiring if defective.
13	Oscilloscope waveform is abnormal (step 21).	*a.* Defective transistor(s) 1A1Q1 and/or 1A1Q6.	*a.* Check transistor(s) and replace if defective.
		b. Defective threshold detector diode 1A1CR13.	*b.* Check diode and replace if defective.
		c. Defective Zener diode(s) 1A1CR4 and/or 1A1CR6.	*c.* Check diode(s) and replace if defective.
		d. Defective diode(s) 1A1CR5 and/or 1A1CR14.	*d.* Check diode(s) and replace if defective.
		e. Defective operational amplifier assembly 1A1A1.	*e.* Same as item 2*e*.

c. Voltage Resistance (V & R) Measurements.

(1) *Voltage measurements.* To perform voltage measurements on intervalometer module 1A1, proceed as follows:

(*a*) Insert intervalometer module 1A1 into INTERVALOMETER connector J2 of module test adapter.

(*b*) Connect pendant cable connector o module test adapter to MODULES connector J1 (CONTROL-POWER SUPPLY section) on LS-80A.

(*c*) Connect +28-volt dc and 115-volt a power sources to POWER connector J1 on LS 80A.

(*d*) Set switches and controls on LS-80. as follows:

1. MASTER switch (MASTER section) o CONTROL PWR SUPPLY position.

2. E V/H 0-50 VOLTS control (CON-TROL-POWER SUPPLY section) to 25.

3. POWER switch (PANEL POWER ection) to ON position.

4. MODULE TEST switch (CON-TROL-POWER SUPPLY section) to INTVL OPR osition. Allow 15 minutes for warmup.

5. Set other switches and controls to heir OFF, neutral or counterclockwise positions.

(*e*) Using the multimeter, perform the oltage measurements at test points and on pins f intervalometer module 1A1 connector as indi-ated below.

Multimeter +	Multimeter –	Range	Voltage
P2	S	50vdc	+38 to 40
	TP1	50vdc	–36.8 to –38.8
P3	S		
	S	250vac	108 to 118 vac
	S	50vdc	+24 to +26 vdc
	S	50vdc	+26.5 to +29.5 vdc
	S	50vdc	+26.5 to +29.5 vdc

(2) *Resistance measurements.* Note that this quipment is transistorized. The resistance meas-rements in the following chart are obtained with o power applied to the intervalometer module A1 and no external connections to connector XA1. Using the multimeter, perform the resist-nce measurements on pins of connector 1XA1 indicated below.

Multimeter +	Multimeter –	Range	Resistance (ohms)
B	A	RX1,000	22 to 28K
C	A	RX10,000	infinite
D	A	RX10,000	infinite
E	A	RX10,000	infinite
F	A	RX10,000	infinite
H	A	RX1,000	18 to 22K
K	A	RX10,000	infinite
P	A	RX10,000	infinite
S	A	RX10,000	infinite
T	A	RX100	330 to 370

-12. Photo System Assembly (Unit 1) Film Drive Amplifier Module 1A2 Troubleshooting

eneral support troubleshooting procedure for e photo system assembly film drive amplifier odule 1A2 are given below.

a. Operational Check.

(1) Insert film drive amplifier module 1A2 into FILM DRIVE AMPLIFIER connector J3 of module test adapter.

(2) Connect plug tip of connector TP2 (adjacent to FILM DRIVE AMPLIFIER connector J3) on module test adapter to test point TP2 on film drive amplifier module 1A2.

(3) Connect plug tip of connector TP3 (adjacent to FILM DRIVE AMPLIFIER connector J3) on module test adapter to test point TP3 on film drive amplifier module 1A2.

(4) Connect plug tip of connector TP4 (adjacent to FILM DRIVE AMPLIFIER connector J3) on module test adapter to test point TP4 on film drive amplifier module 1A2.

NOTE

Do not connect R C bridge and digital timer in this test setup (fig. 5-14).

(5) Connect module test adapter, test equipment and LS-80A as shown in test setup (fig. 5-14). Use Digital Voltmeter ME-218/GSM-64 in test setup. Turn ac and dc power sources on.

NOTE

Refer to figure 5-13 for location of controls and indicators on LS-80A.

(6) Set switches and controls on LS-80A as follows:

(*a*) MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

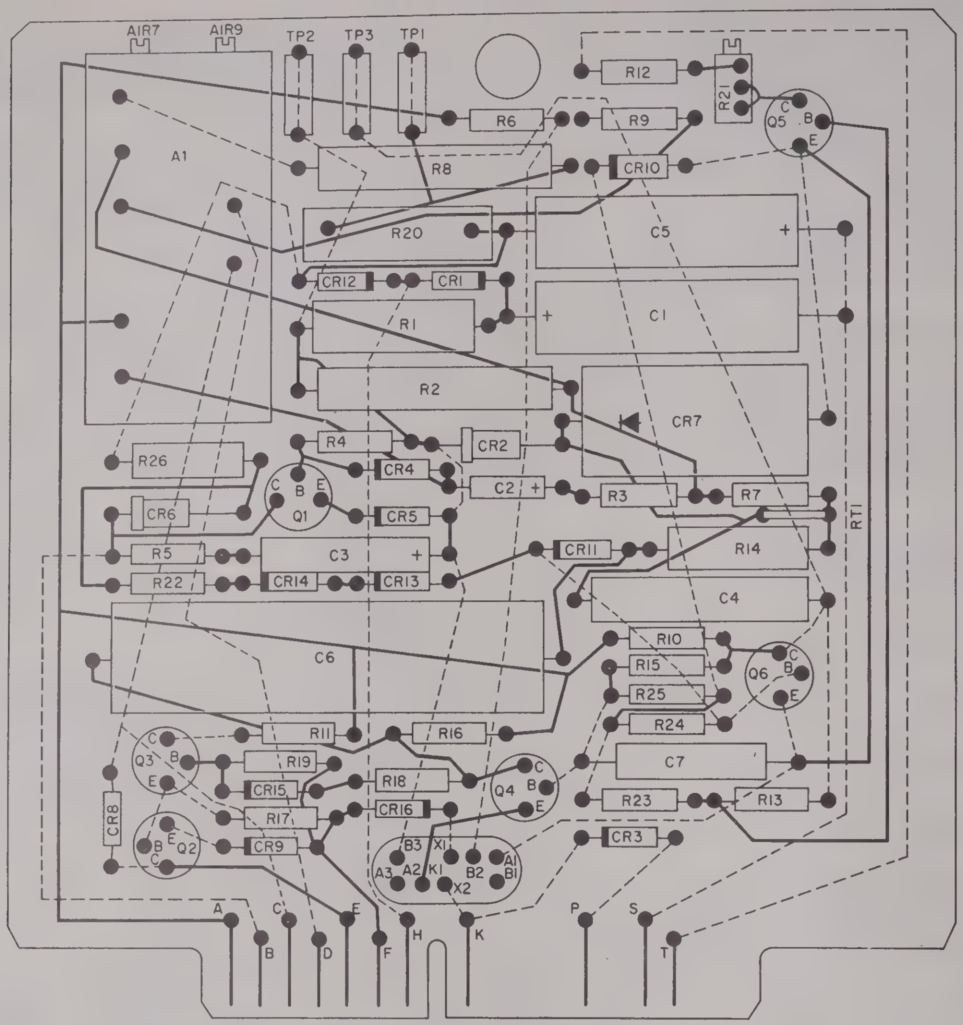
(*b*) E V/H 0-50 VOLTS control (CON-TROL-POWER SUPPLY section) to 25.

(*c*) POWER switch (PANEL POWER section) to ON position. Allow 15 minutes for warmup.

(*d*) All other switches and controls to their OFF, neutral or counterclockwise positions.

(7) Set MODULE TEST switch (CON-TROL-POWER SUPPLY section) on LS-80A to FDA OPR position. The DC VOLTS and SCOPE indicators (MASTER section), and MAN PIC and MODULE FILM DRIVE indicators (CON-TROL-POWER SUPPLY section) on LS-80A should light. The oscilloscope should indicate voltage spikes at 800 Hz.

(8) Set E V/H 0-50 VOLTS control CON-TROL-POWER SUPPLY section) on LS-80A to the positions indicated in the following table. Refer to the result/indication column for indications on digital voltmeter that are expected for each position of the E V/H 0-50 VOLTS control.



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ----- WIRING ON BACK OF BOARD.
4. ━━━ WIRING ON FRONT OF BOARD.
5. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO.1 AND ASSEMBLY NO. A1 (1A1).

EL6720-250-35-TM-75

Figure 5-16. Photo system assembly intervalometer module 1A1, wiring diagram.

E V/H 0-50 VOLTS control setting	Result/indication
	Digital Voltmeter (vdc)
1.0	-1.33 to -1.48
2.0	-2.67 to -2.96
5.0	-6.69 to -7.40
10	-13.38 to -14.80
20	-26.78 to -29.60
25	-33.47 to -37.00
35	-46.86 to -51.80
50	-66.95 to -74.00

NOTE

Replace digital voltmeter with vtvm in test setup (fig. 5-14).

(9) Set E V/H 0-50 VOLTS control (CONTROL-POWER SUPPLY section) on LS-80A to 25. Depress PLUS OUTPUT switch (CONTROL-POWER SUPPLY section) on LS-80A. The vtvm indication should be greater than 3 volts dc.

(10) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to FDA R13 ADJ position. The vtvm should indicate from 0 to +5 volts dc.

(11) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to FDA R9 ADJ position. The vtvm should indicate from 0 to +5 volts dc.

(12) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to FDA +6 VDC position. The vtvm should indicate from +5.6 to +6.8 volts dc. The oscilloscope ripple should be less than 100 millivolts peak-to-peak.

(13) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to FDA -6 VDC position. The vtvm should indicate from -5.6 to -6.8 volts dc.

(14) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) to FDA TP2 position. The oscilloscope should indicate voltage spikes at 800 Hz (1.25 cm) as shown in figure 5-17.

(15) Set POWER switch (PANEL POWER section) on LS-80A to OFF position. All indicators should go out.

(16) Turn ac and dc power sources off.

(17) Disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3-11) wiring diagram (fig. 5-18) and parts location diagram (fig. 5-39).

CAUTION

This equipment is transistorized. Use multimeter RX100 ohms range to measure circuit resistances, thereby preventing possible damage or destruction to transistors due to excessive current.

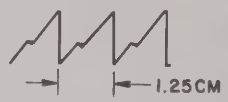


Figure 5-17. Film drive amplifier module 1A2, waveform.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	DC VOLTS, SCOPE and MODULE FILM DRIVE indicators on LS-80A do not light (step 7).	*a.* Defective thermistor 1A2A1RT1	*a.* Check for 10 to 70 ohms resistance between terminals 2 and 3 of transistor and thermistor assembly 1A2A1. If proper indication cannot be obtained, replace defective transistor and thermistor assembly.
		b. Defective wiring	*b.* Repair or replace wiring if defective.
2	Oscilloscope current spikes abnormal (step 7).	*a.* Defective transistor and thermistor assembly 1A2A1.	*a.* Check assembly and replace if defective.
		b. Defective control rectifier power assembly 1A2A2.	*b.* Check assembly and replace if defective.
		c. Defective transistor(s) 1A2Q1 through 1A2Q3.	*c.* Check transistor(s) and replace if defective.
		d. Defective diode(s) 1A2CR1 through 1A2CR6 and/or 1A2CR9 through 1A2CR12.	*d.* Check diode(s) and replace if defective.
		e. Defective transformer 1A2T1	*e.* Check transformer as follows: (1) Check for 120 ± 12 ohms resistance between terminals 1 and 2. (2) Check for 32 ± 6 ohms resistance between terminals 3 and 4. (3) Check for 32 ± 6 ohms resistance between terminals 4 and 5. (4) If any resistance measurements ((1) through (3) above) are out of tolerance, replace defective transformer.
		f. Defective wiring	*f.* Repair or replace wiring if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
3	Digital voltmeter is not within tolerance for various E V/H 0-50 volts on LS-80A settings (step 8).	*a.* Defective transistor and thermistor assembly 1A2A1. *b.* Defective control rectifier power assembly 1A2A2. *c.* Defective transistor(s) 1A2Q1 through 1A2Q3. *d.* Defective diode(s) 1A2CR1 through 1A2CR6 and/or 1A2CR9 through 1A2CR12. *e.* Defective transformer 1A2T1 *f.* Defective wiring	*a.* Same as item 1*a*. *b.* Check assembly and replace if defective. *c.* Check transistor(s) and replace if defective. *d.* Check diode(s) and replace if defective. *e.* Same as item 2*e*. *f.* Repair or replace wiring if defective.
4	Vtvm indication is not greater than 3 volts dc (step 9).	*a.* Defective transistor and thermistor assembly 1A2A1. *b.* Defective control rectifier power assembly 1A2A2. *c.* Defective transistor(s) 1A2Q1 through 1A2Q3. *d.* Defective diode(s) 1A2CR1 through 1A2CR6 and/or 1A2CR9 through 1A2CR12. *e.* Defective transformer 1A2T1 *f.* Defective wiring	*a.* Same as item 1*a*. *b.* Check assembly and replace if defective. *c.* Check transistor(s) and replace if defective. *d.* Check diode(s) and replace if defective. *e.* Same as item 2*e*. *f.* Repair or replace wiring if defective.
5	Vtvm does not indicate from 0 to +5 volts dc (step 10).	*a.* Variable resistor 1A2R13 not properly adjusted. *b.* Defective transistor and thermistor assembly 1A2A1. *c.* Defective control rectifier power assembly 1A2A2. *d.* Defective transistors 1A2Q1 through 1A2Q3. *e.* Defective diode(s) 1A2CR1 through 1A2CR6 and/or 1A2CR9 through 1A2CR12. *f.* Defective transformer 1A2T1 *g.* Defective wiring	*a.* Adjust variable resistor as directed in paragraph 5-55*b*(3). *b.* Same as item 1*a*. *c.* Check assembly and replace if defective. *d.* Check transistor(s) and replace if defective. *e.* Check diode(s) and replace if defective. *f.* Same as item 2*e*. *g.* Repair or replace wiring if defective.
6	Vtvm does not indicate from 0 to + 5 volts dc (step 11).	*a.* Variable resistor 1A2R9 not properly adjusted. *b.* Defective transistor and thermistor assembly 1A2A1. *c.* Defective control rectifier power assembly 1A2A2. *d.* Defective transistor(s) 1A2Q1 through 1A2Q3. *e.* Defective diode(s) 1A2CR1 through 1A2CR6 and/or 1A2CR9 through 1A2CR12. *f.* Defective transformer 1A2T1 *g.* Defective wiring	*a.* Adjust variable resistor as directed in paragraph 5-55*b*(4). *b.* Same as item 1*a*. *c.* Check assembly and replace if defective. *d.* Check transistor(s) and replace if defective. *e.* Check diode(s) and replace if defective. *f.* Same as item 2*e*. *g.* Repair or replace wiring if defective.
7	Vtvm does not indicate from +5.6 to +6.8 volts dc (step 12).	*a.* Defective Zener diode 1A2CR9 *b.* Defective diode(s) 1A2CR1 and/or 1A2CR6. *c.* Defective capacitor 1A2C2 *d.* Defective transformer 1A2T1 *e.* Defective resistor 1A2R2 *f.* Defective wiring	*a.* Check diode and replace if defective. *b.* Check diode(s) and replace if defective. *c.* Check capacitor and replace if defective. *d.* Same as item 2*e*. *e.* Check resistor for 47K ± 235 resistance. If necessary, replace defective resistor. *f.* Repair or replace wiring if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
8	Oscilloscope ripple is not less than 1 cm peak-to-peak (step 12).	*a.* Defective capacitor 1A2C2	*a.* Check capacitor and replace if defective.
		b. Defective diode(s) 1A2CR1 and/or 1A2CR6.	*b.* Check diode(s) and replace if defective.
9	Vtvm does not indicate from –5.6 to –6.8 volts dc (step 13).	*a.* Defective zener diode 1A2CR10	*a.* Check diode and replace if defective.
		b. Defective diode(s) 1A3CR3 and/or 1A3CR4.	*b.* Check diode(s) and replace if defective.
		c. Defective capacitor 1A2C3	*c.* Check capacitor and replace if defective.
		d. Defective transformer 1A2T1	*d.* Same as item 2*e*.
		e. Defective resistor 1A2R7	*e.* Check resistor for 22K ±110 ohms resistance. If necessary, replace defective resistor.
		f. Defective wiring	*f.* Repair or replace wiring if defective.
10	Oscilloscope current spikes abnormal (step 14).	*a.* Defective transistor and thermistor assembly 1A2A1.	*a.* Same as item 1*a*.
		b. Defective transistor(s) 1A2Q1 and/or 1A2Q2.	*b.* Check transistor(s) and replace if defective.
		c. Defective capacitor 1A2C4	*c.* Check capacitor and replace if defective.
		d. Defective wiring	*d.* Repair or replace wiring if defective.

c. Voltage and Resistance (V & R) Measurements.

(1) *Voltage measurements.* To perform voltage measurements on film drive amplifier module 1A2, proceed as follows:

(*a*) Insert film drive amplifier module 1A2 into FILM DRIVE AMPLIFIER connector J3 of module test adapter.

(*b*) Connect pendant cable connector of module test adapter to MODULES connector J11 (CONTROL-POWER SUPPLY section) on LS–80A.

(*c*) Connect +28-volt dc and 115-volt ac power sources to POWER connector J1 on LS–80A.

(*d*) Set switches and controls on LS–80A as follows:

1. MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

2. E V/H 0–50 VOLTS control (CONTROL-POWER SUPPLY section) to 25.

3. POWER switch (PANEL POWER section) to ON position.

4. MODULE TEST switch (CONTROL-POWER SUPPLY section) to FDA OPR position. Allow 15 minutes for warmup.

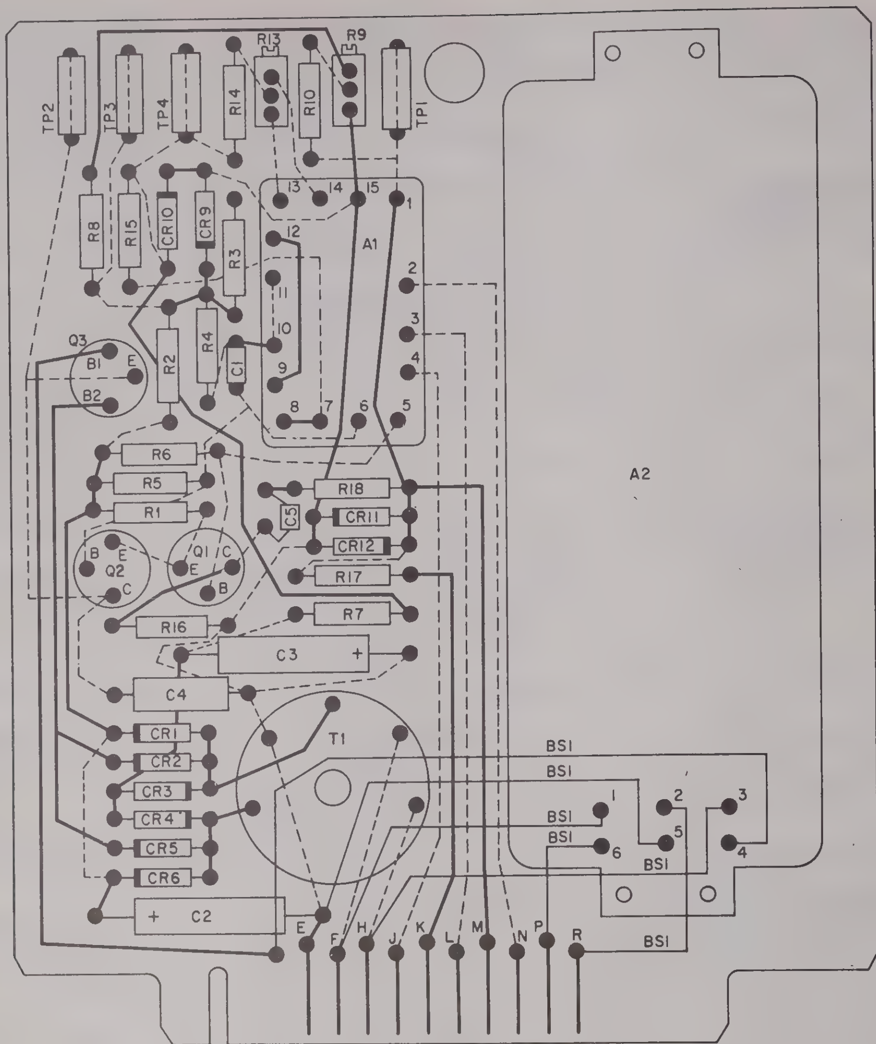
5. All other switches and controls to their OFF, neutral or counterclockwise positions.

(*e*) Using the multimeter, perform the voltage measurements at test points and on pins of film drive amplifier module 1A2 connector as indicated below.

Multimeter		Range	Voltage
+	–		
TP1	E		
TP2	E		
TP3	E	10 vdc	+5.7 to +6.7 vdc
TP4	E	10 vdc	–5.7 to –6.7 vdc
H	F	250 vac	108 to 118 vac
M	F		
N	E	50 vdc	+26.5 to +29.5 vdc
P	E		
K	E		
R	E		

(2) *Resistance measurements.* Note that this equipment is transistorized. The resistance measurements in the following chart are obtained with no power applied to the film drive amplifier module 1A2 and no external connection to connector 1XA2. Using the multimeter, perform the resistance measurements on pins of connector 1XA2 as indicated below.

Multimeter		Range	Resistance (ohms)
+	–		
F	E	RX10,000	infinite
H	E	RX10,000	infinite
J	E	RX10,000	infinite
K	E	RX10,000	infinite
L	E	RX10,000	infinite
M	E	RX100	300 to 340
N	E	RX10,000	infinite
P	E	RX10,000	infinite
R	E	RX10,000	infinite



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ---- WIRING ON BACK OF BOARD.
4. ━━━ WIRING ON FRONT OF BOARD.
5. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO. 1 AND ASSEMBLY NO. A2 (1A2).

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Figure 5-18. Photo system assembly film drive amplifier module 1A2, wiring diagram.

5-13. Photo System Assembly (Unit 1) PC Board and Component Assembly Module 1A3 Troubleshooting

General support troubleshooting procedures for the photo system assembly printed circuit board and component assembly module 1A3 are given below.

a. Operational Check.

(1) Insert PC board and component assembly module 1A3 into AUXILIARY connector J1 of module test adapter (component side of board facing connectors J2 and J3).

NOTE

Do not connect vtvm or digital voltmeter, oscilloscope, or digital timer in this test setup (fig. 5-14).

(2) Connect module test adapter, test equipment and LS-80A as shown in test setup (fig. 5-14). Turn ac and dc power sources on.

NOTE

Refer to figure 5-13 for the location of controls and indicators on LS-80A.

(3) Set switches and controls on LS-80A as follows:

(*a*) MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

(*b*) CONFIGURATION switch (CONTROL-POWER SUPPLY section) to 44MM VERT position.

(*c*) POWER switch (PANEL POWER section) to ON position. Allow 15 minutes for warmup.

(*d*) All other switches and controls to their OFF, neutral or counterclockwise positions.

(4) Set TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to AUX BD INTVL position. The RC BRDG indicator (MASTER section) on LS-80A should light.

(5) Set CONFIGURATION switch (CONTROL-POWER SUPPLY section) on LS-80A to the positions indicated below in the following table. Refer to the result/indication column for indicators (CONTROL-POWER SUPPLY section) on LS-80A that are expected to light for each position of the CONFIGURATION switch.

CONFIGURATION switch setting	*Result/indication*
44MM VERT	VERT POS indicator should light.
3 IN. 15° R	RELAY OPR and MOUNT AC indicators should light. VERT POS indicator should go out.
3 IN. 30° R	RELAY OPR and MOUNT AC indicators should light.
3 IN. VERT	VERT POS and MOUNT AC indicators should light. RELAY OPR indicator should go out.
6 IN. 15° L	RELAY OPR and MOUNT AC indicators should light. VERT POS indicator should go out.
6 IN. 30° L	RELAY OPR and MOUNT AC indicators should light. RELAY OPR indicator should go out.
6 IN. VERT	VERT POS and MOUNT AC indicators should light. RELAY OPR indicator should go out.
12 IN. 15° L	RELAY OPR and MOUNT AC indicators should light. VERT POS indicator should go out.
12 IN. 30° L	RELAY OPR and MOUNT AC indicators should light.
12 IN. VERT	VERT POS and MOUNT AC indicators should light. RELAY OPR indicator should go out.

(6) Set TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to AUX BD FDA position.

(7) Repeat (5) above and observe same indications.

(8) Set TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to AUX BD INTVL position.

(9) Set CONFIGURATION switch (CONTROL-POWER SUPPLY section) on LS-80A to the positions indicated below in the following table. Refer to result/indication column for indications on R C bridge that are expected for each position of the CONFIGURATION switch.

CONFIGURATION switch setting	*Result/indication*
	R C bridge (ohms)
44MM VERT	114.5 to 115.5 K
3 IN. 15° R	116.17 to 167.83 K
3 IN. 30° R	131.4 to 132.6° K
3 IN. VERT	66.2 to 66.8 K
6 IN. 15° L	119.4 to 120.6 K
6 IN. 30° L	77.4 to 78.0 K
6 IN. VERT	33.04 to 33.36 K
12 IN. 15° L	60.1 to 60.7 K
12 IN. 30° L	39.01 to 39.39 K
12 IN. VERT	16.42 to 16.58 K

(10) Set TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to AUX BD FDA position.

(11) Set CONFIGURATION switch (CONTROL-POWER SUPPLY section) on LS-80A to the positions indicated below in the following table. Refer to result/indication column for indications on RC bridge that are expected for each position of the CONFIGURATION switch.

CONFIGURATION switch setting	*Result/indication*
	R C bridge (ohms)
44MM VERT	490.6 to 495.4 K
3 IN. 15° R	711.5 to 718.5 K
3 IN. 30° R	567.2 to 571.8 K
3 IN. VERT	282.6 to 285.4 K
6 IN. 15° L	515.5 to 519.5 K
6 IN. 30° L	334.3 to 337.7 K
6 IN. VERT	141.3 to 142.7 K
12 IN. 15° L	256.7 to 259.3 K
12 IN. 30° L	166.2 to 167.8 K
12 IN. VERT	70.25 to 70.95K

(12) Set POWER switch (PANEL POWER section) on LS-80A to OFF position. All indicators should go out.

(13) Turn ac and dc power sources off.

(14) Disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a above*). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 3-13), wiring diagram (fig. 5-19) and parts location diagram (fig. 5-41).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	VERT POS indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 44MM VERT position (step 5).	*a.* Defective relay(s) 1A3K8 through 1A3K11. *b.* Defective wiring	*a.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s). *b.* Repair or replace wiring if defective.
2	RELAY OPR indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 3 IN 15°R position (step 5).	*a.* Defective 15° right relay 1A3K11 *b.* Defective relay(s) 1A3K8, 1A3K9 and/or 1A3K10. *c.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s). *c.* Repair or replace wiring if defective.
3	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 3 IN. 15°R position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace defective relay(s).
4	RELAY OPR indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 3 IN. 30°R position (step 5).	*a.* Defective 30° right relay 1A3K9 *b.* Defective relay(s) 1A3K8, 1A3K10 and/or 1A3K11.	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s).
5	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 3 IN. 30° position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
6	VERT POS indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 3 IN. VERT position (step 5).	*a.* Defective relay(s) 1A3K8 through 1A3K11. *b.* Defective wiring	*a.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s). *b.* Repair or replace wiring if defective.
7	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 3 IN. VERT position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
8	RELAY OPR indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 6 IN. 15°L position (step 5).	*a.* Defective 15° left relay 1A3K10 *b.* Defective relay(s) 1A3K8, 1A3K9 and/or 1A3K11.	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s).

em No.	Trouble symptom	Probable cause	Checks and corrective measures
9	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 6 IN. 15°L position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
0	RELAY OPR indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 6 IN. 30°L position (step 5).	*a.* Defective 30° left relay 1A3K8 *b.* Defective relay(s) 1A3K9 through 1A3K11.	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check coil of each relay for 450 550 ohms resistance. If necessary, replace defective relay(s).
1	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 6 IN. 30°L position (step 5).	*a.* Defective LA-370A (1 3/4 inch) 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
2	VERT POS indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 6 IN. VERT position (step 5).	*a.* Defective relay(s) 1A3K8 through 1A3K11. *b.* Defective wiring	*a.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s). *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
3	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 6 IN. VERT position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
4	RELAY OPR indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 12 IN. 15°L position (step 5).	*a.* Defective 15° left relay 1A3K10 *b.* Defective relay(s) 1A3K8, 1A3K9 and/or 1A3K11.	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s).
5	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 12 IN. 15°L position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
			between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
16	RELAY OPR indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 12 IN. 30°L position (step 5).	*a.* Defective 30° left relay 1A3K8 *b.* Defective relay(s) 1A3K9 through 1A3K11.	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s).
17	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 12 IN. 30°L position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
18	VERT POS indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 12 IN. VERT position (step 5).	*a.* Defective relay(s) 1A3K8 through 1A3K11. *b.* Defective wiring	*a.* Check coil of each relay for 450 to 550 ohms resistance. If necessary, replace defective relay(s). *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
19	MOUNT AC indicator on LS-80A does not light with CONFIGURATION switch on LS-80A in 12 IN. VERT position (step 5).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check for continuity between pin 10 of connector and terminal 2 of LA-370A (1 3/4 inch) relay 1A3K7. Check for continuity between pin 9 of connector and terminal 13 of LA-370A (1 3/4 inch) relay 1A3K7. Repair or replace wiring if defective.
20	R C bridge does not indicate from 114.5 to 115.5K ohms resistance with CONFIGURATION switch on LS-80A in 44MM VERT position (step 9).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7. *b.* Defective resistor 1A3R17 *c.* Defective wiring	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay. *b.* Check resistor for 115K ± 575 ohms resistance. If necessary, replace defective resistor. *c.* Repair or replace wiring if defective.
21	R C bridge does not indicate from 166.17 to 167.83K ohms resistance with CONFIGURATION switch on LS-80A in 3 IN. 15°R position (step 9).	*a.* Defective relay(s) 1A3K6 and/or 1A3K4. *b.* Defective resistor 1A3R19 *c.* Defective wiring	*a.* Check coil of relay 1A3K6 for 600 to 900 ohms resistance. Check coil of relay 1A3K4 for 450 to 550 ohms resistance. If necessary, replace defectice relay(s). *b.* Check resistor for 167K ± 835 ohms resistance. If necessary, replace defective resistor. *c.* Repair or replace wiring if defective.
22	R C bridge does not indicate from 131.4 to 132.6K ohms resistance with CONFIGURATION switch on LS-80A in 3 IN. 30°R position (step 9).	*a.* Defective relay(s) 1A3K3 and/or 1A3K6.	*a.* Check coil of relay 1A3K3 for 450 to 550 ohms resistance. Check coil of relay 1A3K6 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		b. Defective resistor 1A3R14	*b.* Check resistor for 132K ± 660 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
23	R C bridge does not indicate from 66.2 to 66.8K ohms resistance with CONFIGURATION switch on LS-80A in 3 IN. VERT position (step 9).	*a.* Defective relay(s) 1A3K3 through 1A3K7.	*a.* Check coil of each relay 1A3K3, 1A3K4 and 1A3K7 for 450 to 550 ohms resistance. Check coil of each relay 1A3K5 and 1A3K6 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R15	*b.* Check resistor for 66.5K ± 330 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
24	R C bridge does not indicate from 119.4 to 120.6K ohms resistance with CONFIGURATION switch on LS-80A in 6 IN. 15°L position (step 9).	*a.* Defective any 15° relay 1A3K4	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R18	*b.* Check resistor for 120K ± 600 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
25	R C bridge does not indicate from 77.4 to 78.0K ohms resistance with CONFIGURATION switch on LS-80A in 6 IN. 30°L position (step 9).	*a.* Defective any 30° relay 1A3K3	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R11	*b.* Check resistor for 77.7K ± 380 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
26	R C bridge does not indicate from 33.04 to 33.36K ohms resistance with CONFIGURATION switch on LS-80A in 6 IN. VERT position (step 9).	*a.* Defective relay(s) 1A3K3 through 1A3K7.	*a.* Check coil of each relay 1A3K3, 1A3K4 and 1A3K7 for 450 to 550 ohms resistance. Check coil of each relay 1A3K5 and 1A3K6 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R12	*b.* Check resistor for 33.2K ± 165 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
27	R C bridge does not indicate from 60.1 to 60.7K resistance with CONFIGURATION switch on LS-80A in 12 IN. 15°L position (step 9).	*a.* Defective relay(s) 1A3K4 and/or 1A3K5 defective.	*a.* Check coil of relay 1A3K4 for 450 to 550 ohms resistance. Check coil of relay 1A3K5 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R20	*b.* Check resistor for 60.4K ± 300 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
28	R C bridge does not indicate from 39.01 to 39.39K ohms resistance with CONFIGURATION switch on LS-80A in 12 IN. 30°L position (step 9).	*a.* Defective relay(s) 1A3K3 and/or 1A3K5.	*a.* Check coil of relay 1A3K3 for 450 to 550 ohms resistance. Check coil of relay 1A3K5 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R16	*b.* Check resistor for 39.2K ± 195 ohms resistance. If necessary, replace defective resistor.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		c. Defective wiring	*c.* Repair or replace wiring if defective.
29	R C bridge does not indicate from 16.42 to 16.58K ohms resistance with CONFIGURATION switch on LS-80A in 12 IN. VERT position (step 9).	*a.* Defective LA-372A (12 inch) relay 1A3K5.	*a.* Check coil of relay for 600 to 900 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R13	*b.* Check resistor for 16.5K ± 80 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
30	R C bridge does not indicate from 490.6 to 495.4K ohms resistance with CONFIGURATION switch on LS-80A in 44MM VERT position (step 11).	*a.* Defective LA-370A (1 3/4 inch) relay 1A3K7.	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R7	*b.* Check resistor for 493K ± 2,465 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
31	R C bridge does not indicate from 711.5 to 718.5K ohms resistance with CONFIGURATION switch on LS-80A in 3 IN. 15°R position (step 11).	*a.* Defective relay(s) 1A3K2 and/or 1A3K6.	*a.* Check coil of relay 1A3K2 for 450 to 550 ohms resistance. Check coil of relay 1A3K6 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R9	*b.* Check resistor for 715K ± 3,575 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
32	R C bridge does not indicate from 562.2 to 571.8K ohms resistance with CONFIGURATION switch on LS-80A in 3 IN. 30°R position (step 11).	*a.* Defective relay(s) 1A3K1 and/or 1A3K6.	*a.* Check coil of relay 1A3K1 for 450 to 550 ohms resistance. Check coil of relay 1A3K6 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R4	*b.* Check resistor for 569K ± 2,845 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
33	R C bridge does not indicate from 282.6 to 285.4K ohms resistance with CONFIGURATION switch on LS-80A in 3 IN. VERT position (step 11).	*a.* Defective LA-371A (3 inch) relay 1A3K6.	*a.* Check coil of relay for 600 to 900 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R5	*b.* Check resistor for 284K ± 1,420 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
34	R C bridge does not indicate from 515.5 to 519.5K ohms resistance with CONFIGURATION switch on LS-80A in 6 IN. 15°L position (step 11).	*a.* Defective any 15° relay 1A3K2	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R8	*b.* Check resistor for 517K ± 2,585 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
35	R C bridge does not indicate from 334.3 to 337.7K ohms resistance with CONFIGURATION switch on LS-80A in 6 IN. 30°L position (step 11).	*a.* Defective any 30° relay 1A3K1	*a.* Check coil of relay for 450 to 550 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R1	*b.* Check resistor for 336K ± 1,680 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
36	R C bridge does not indicate from 141.3 to 142.7K ohms resistance with CONFIGURATION switch on LS-80A in 6 IN. VERT position (step 11).	*a.* Defective relay(s) 1A3K1, 1A3K2, and/or 1A3K5 through 1A3K7.	*a.* Check coil of each relay 1A3K1, 1A3K2, and 1A3K7 for 450 to 550 ohms resistance. Check coil of each relay 1A3K5 and 1A3K6 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R2	*b.* Check resistor for 142K ± 710 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
37	R C bridge does not indicate from 256.7 to 259.3K ohms resistance with CONFIGURATION switch on LS-80A in 12 IN. 15°L position (step 11).	*a.* Defective relay(s) 1A3K2 and/or 1A3K5.	*a.* Check coil of relay 1A3K2 for 450 to 550 ohms resistance. Check coil of relay 1A3K5 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R10	*b.* Check resistor for 258K ± 1,290 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
38	R C bridge does not indicate from 166.2 to 167.8K ohms resistance with CONFIGURATION switch on LS-80A in 12 IN. 30°L position (step 11).	*a.* Defective relay(s) 1A3K1 and/or 1A3K5.	*a.* Check coil of relay 1A3K1 for 450 to 550 ohms resistance. Check coil of relay 1A3K5 for 600 to 900 ohms resistance. If necessary, replace defective relay(s).
		b. Defective resistor 1A3R6	*b.* Check resistor for 167K ± 835 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.
39	R C bridge does not indicate from 70.25 to 70.95K ohms resistance with CONFIGURATION switch on LS-80A in 12 IN. VERT position (step 11).	*a.* Defective LA-372A (12 inch) relay 1A3K5.	*a.* Check coil of relay for 600 to 900 ohms resistance. If necessary, replace defective relay.
		b. Defective resistor 1A3R3	*b.* Check resistor for 70.6K ± 350 ohms resistance. If necessary, replace defective resistor.
		c. Defective wiring	*c.* Repair or replace wiring if defective.

c. Voltage and Resistance (V & R) Measurements.

(1) *Voltage measurements.* To perform voltage measurements on printed circuit board and component assembly module 1A3, proceed as follows:

(*a*) Insert printed circuit board and component assembly module 1A3 into printed circuit board and component assembly connector J1 of module test adapter (component side of board facing connector J2 and J3).

(*b*) Connect pendant cable connector of module test adapter to MODULES connector J11 (CONTROL-POWER SUPPLY section) on LS-80A.

(*c*) Connect +28-volt dc and 115-volt ac power sources to POWER connector J1 on LS-80A.

(*d*) Set switches and controls on LS-80A as follows:

1. MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

2. TEST switch (CONTROL-POWER SUPPLY section) to AUX BD INTVL position.

3. CONFIGURATION switch (CONTROL-POWER SUPPLY section) to 44MM VERT position.

4. POWER switch (PANEL POWER section) to ON position. Allow 15 minutes for warmup.

5. All other switches and controls to their OFF, neutral or counterclockwise positions.

(*e*) Using the multimeter, perform the voltage measurements on pins of printed circuit board and component assembly module 1A3 connector as indicated below.

Multimeter +	Multimeter −	Range	Voltage
2	22	50 vdc	+26.5 to 29.5 vdc
21	22	50 vdc	+26.5 to 29.5 vdc
10	22	250 vac	108 to 118 vac
9	22		
1	22		
31	22		

(2) *Resistance measurements.* The resistance measurements in the following chart are obtained with no power applied to the printed circuit board and component assembly module 1A3 and no external connections to connector 1XA3. Using the multimeter, perform the resistance measurements on pins of connector 1XA3 as indicated below.

Multimeter +	Multimeter −	Range	Resistance (ohms)
21	33	RX1	0
18	36	RX1	0
23	22	RX10,000	Infinite
22	30	RX10,000	Infinite
23	10	RX10,000	Infinite
19	14	RX10	270 to 330
14	19	RX10	450 to 550
28	14	RX10	270 to 330
14	28	RX10	450 to 550
24	14	RX10	270 to 330
14	24	RX10	450 to 550
34	14	RX10	270 to 330
14	34	RX10	450 to 550
7	2	RX10	270 to 330
2	7	RX10	450 to 550
6	2	RX10	301.5 to 368.5
2	6	RX10	600 (min)
5	2	RX10	301.5 to 368.5
2	5	RX10	600 (min)
3	2	RX10	120 to 180
2	3	RX10	200 to 300
4	2	RX10	120 to 180
2	4	RX10	200 to 300
12	1	RX1,000	141.3 to 142.7K
12	31	RX1,000	33.04 to 33.36K

5–14. Rotary Mount Actuator (Unit 2) Troubleshooting

General support troubleshooting procedures for the rotary mount actuator are given below.

a. Operational Check.

NOTE

Remove cover from rotary mount actuator to gain access to test points.

WARNING

Make sure that 115-volt ac, 400-Hz, and +28-volt dc power sources are off before performing step (1) through (4), below. Dangerous voltages of 115 volts ac, 400 Hz, and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate test cable as shown in figure 5–20.

(2) Connect the connector J1 on test cable (fig. 5–20) to connector 2P1 on rotary mount actuator.

(3) Set switches S1 and S2 on test cable to their off positions.

(4) Connect test cable (fig. 5–20) to 115-volt ac, 400-Hz, and +28-volt dc power sources.

(5) Turn ac and dc power sources on.

NOTE

Condition of indicator lamp on test cable is to be disregarded unless otherwise specified.

(6) Set switch S1 on test cable to on position. Allow 15 minutes for warmup.

(7) Using the ac voltmeter, connect leads between terminals of power transformer 2T3 on rotary mount actuator as indicated below. Refer to the result/indication column for proper indications.

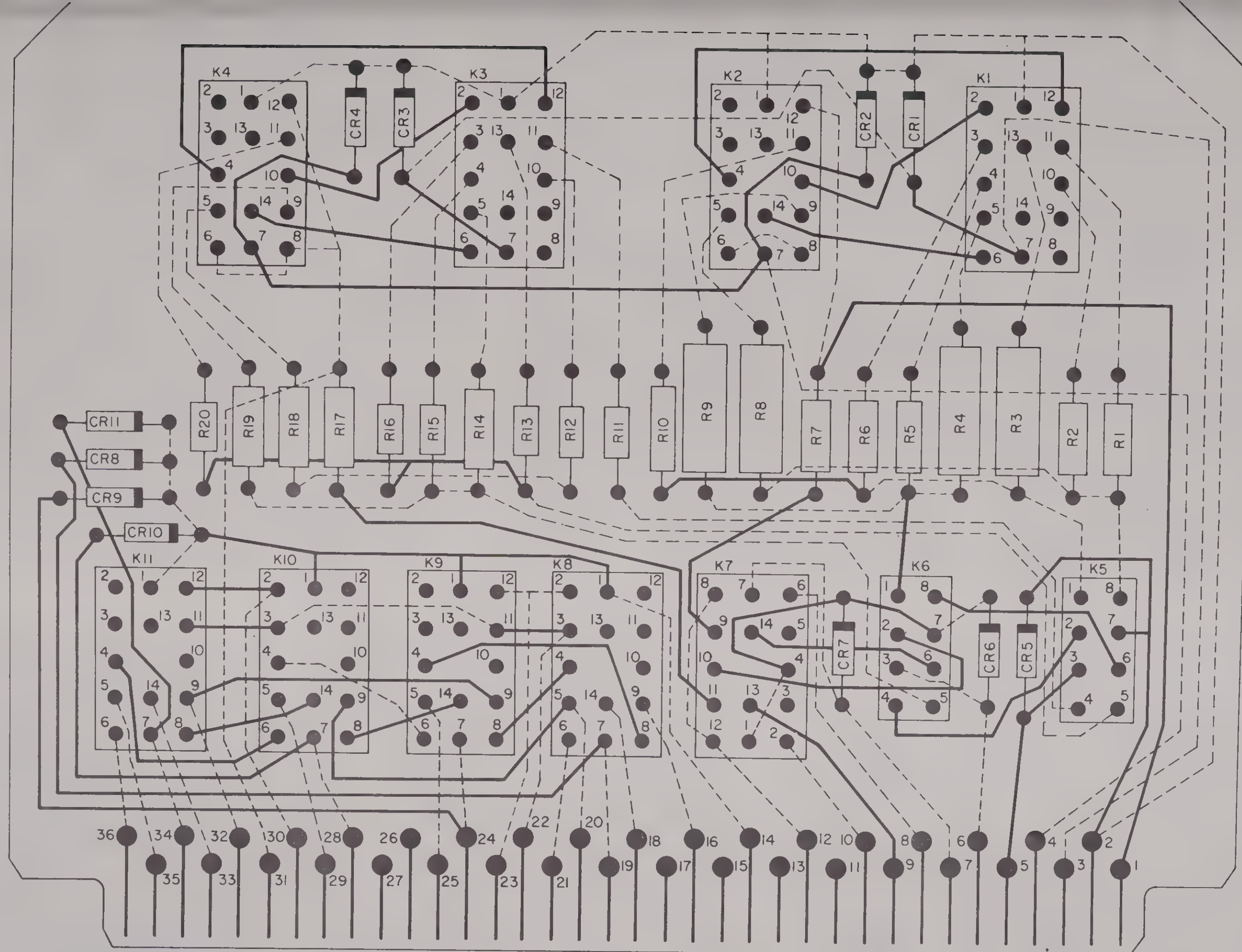
Ac voltmeter +	Ac voltmeter −	Result/indication (volts ac)
2T3–2	2T3–4	113.7 to 117.3
2T3–1	2T3–3	113.7 to 117.3
2T3–5	2T3–3	113.7 to 117.3
2T3–6	2T3–8	9.21 to 9.59
2T3–10	2T3–8	9.21 to 9.59
2T3–7	2T3–8	3.36 to 5.04
2T3–9	2T3–8	3.36 to 5.04
2T3–11	2T3–12	76.44 to 79.56

(8) Using the multimeter on 50 vdc range connect leads between cathode (+) of diode 2A1CR2 and terminal E3 (−) on module 2A1. The multimeter should indicate from +10.8 to 13.2 volts dc.

(9) Using the multimeter on 10 vdc range connect leads between terminal E3 (+) on module 2A1 and anode (−) of diode 2A1CR4. The multimeter should indicate −5.4 to −6.6 volts dc.

(10) Using the multimeter on 10 vdc range connect leads between terminals E15 (+) and E3 (−) on module 2A1. The multimeter should indicate from +8.1 to +9.9 volts dc.

(11) Using the multimeter on 10 vdc range connect leads between terminals E3 (+) and E1 (−) on module 2A1. The multimeter should indicate from −4.6 to −5.6 volts dc.



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH PARTS ARE MOUNTED.
2. ——— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ----- WIRING ON BACK OF BOARD.
4. ——— WIRING ON FRONT OF BOARD.
5. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO.1 AND ASSEMBLY NO. A3 (1A3).

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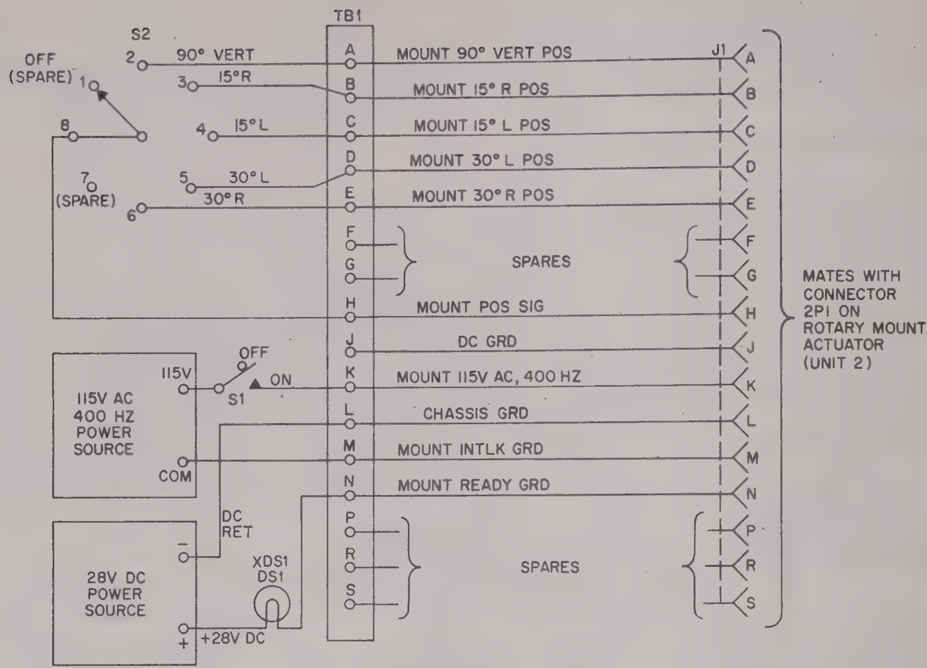
Figure 5–19. Photo system assembly PC board and component module 1A3, wiring diagram.



NOTES:

1. USE THE FOLLOWING PARTS:

REF DES	DESCRIPTION OF MIL STANDARD
CONNECTOR J1	MS3116P-20-16S
TERMINAL BOARD TB1	MS27212-1-16
SWITCH S1	MS35058-22
SWITCH S2	MS25002-1
INDICATOR LIGHT XDS1	MS25256-8
LAMP DS1	MS25237-327
WIRING	NO. 18 AWG.

2. USE CONVENIENT LENGTH OF WIRE AS REQUIRED.
3. REFERENCE DESIGNATORS ARE ARBITRARILY ASSIGNED.

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Figure 5-20. Rotary mount actuator, cable fabrication diagram and test setup.

(12) Using the oscilloscope, connect leads between the base of transistor 2A1Q4 (+) and terminal E3 (–) on module 2A1. The oscilloscope should display a pulse train of positive-going pulses, from ____ to ____ volts peak-to-peak in amplitude, at a frequency of 400 Hz.

(13) Using the oscilloscope, connect leads between the base of transistor 2A1Q5 (+) and terminal E3 (–) on module 2A1. The oscilloscope should display a pulse train of positive-going pulses, from ____ to ____ volts peak-to-peak in amplitude, at a frequency of 400 Hz.

(14) Using the multimeter on 250 vdc range, connect leads between terminals 3 (+) and 1 (–) on potentiometer 2R3. The multimeter should indicate from +180 to +220 volts dc.

(15) Using the multimeter, connect leads between terminals of TB1 on test cable (fig. 5-20) as indicated below. Refer to the result/indication column for proper indications.

Multimeter +	Multimeter –	Range	Result/indication
TB1-A	TB1-C	250 vdc	–80 to –86
TB1-A	TB1-D	250 vdc	–63 to –69
TB1-B	TB1-A	250 vdc	+80 to +86
TB1-E	TB1-A	250 vdc	+63 to +69

(16) On test cable (fig. 5-20) observe that ıdicator lamp DS1 is on.

(17) Using the oscilloscope, connect leads etween terminals E13 (+) and E3 (-) on mod-le 2A1. The oscilloscope should display a pulse rain consisting of a nonsymmetric square wave, rom ____ to ____ volts peak-to-peak in ampli-ıde.

(18) Using the multimeter on 50 vdc range, onnect leads between terminals E14 (+) and E3 -) on module 2A1. The multimeter should indi-ate from +10.8 to +13.2 volts dc.

(19) Using the multimeter on 50 vdc range, onnect leads between terminals E6 (+) add E3 -) on module 2A1. The multimeter should indi-ate +10.8 to +13.2 volts dc.

(20) Using oscilloscope, connect leads etween terminals E9 (+) and E3 (-) on module A1. The oscilloscope should display a pulse rain of positive-going pulses, from ____ to ____ olts peak-to-peak in amplitude, at a frequency of 00 Hz.

(21) Using the multimeter on 10 vdc range, onnect leads between emitter of unijunction ransistor 2A1Q13 (+) and terminal E7 (-) on ıodule 2A1. The multimeter should indicate rom -5.4 to -6.6 volts dc.

(22) Using the multimeter on 10 vdc range, onnect leads between emitter of unijunction ransistor 2A1Q3 (+) and terminal E7 (-) on ıodule 2A1. The multimeter should indicate rom -5.4 to -6.6 volts dc.

NOTE

Indicator lamp DS1 on test cable may remain on if rotary mount actuator has been previously positioned to 90° (vertical).

(23) Set S2 switch on test cable to position (90° vertical). The indicator lamp DS1 goes ıt and then lights within 20 seconds.

(24) Using the multimeter on 50 vdc range, nnect leads between terminals E14 (+) and E3) on module 2A1. The multimeter should indi-te from +10.8 to +13.2 volts dc.

(25) While observing multimeter indication d indicator lamp DS1 on test cable, set switch on test cable to position 4 (15°L). The mul-neter should indicate from 0 to +0.6 volts dc d the indicator lamp DS1 should go out. After naximum of 20 seconds, the multimeter should licate from +10.8 to +13.2 volts dc and indi-or lamp DS1 should light.

(26) Using the multimeter on 50 vdc range, nnect leads between terminals E6 (+) and E3 (-) on module 2A1. The multimeter should indi-cate from +10.8 to +13.2 volts dc.

(27) While observing multimeter indication and indicator lamp DS1 on test cable, set switch S2 to position 3 (15°R). The multimeter should indicate from 0 to +0.6 volts dc and the indicator lamp DS1 should go out. After a maximum of 20 seconds, the multimeter should indicate +10.8 to +13.2 volts dc and the indicator lamp DS1 should light.

(28) Using the oscilloscope, connect a lead between terminal E7 on module 2A1 and floating ground on oscilloscope; connect a lead between terminal E11 on module 2A1 and vertical input on oscilloscope; connect a lead between terminal E9 on module 2A1 and external trigger on oscil-loscope.

(29) While observing oscilloscope display, set switch S2 on test cable to position 4 (15°L). The oscilloscope should display a pulse train of negative-going pulses, from ____ to ____ volts peak-to-peak amplitude, for a maximum of 20 seconds.

(30) Using the oscilloscope, connect a lead between terminal E7 on module 2A1 and floating ground on oscilloscope; connect a lead between terminal E8 on module 2A1 and vertical input on oscilloscope; connect a lead between terminal E9 on module 2A1 and external trigger on oscillo-scope.

(31) While observing oscilloscope display, set switch S2 on test cable to position 3 (15°R). The oscilloscope should display a pulse train of negative-going pulses, from ____ to ____ volts peak-to-peak amplitude, for a maximum of 20 seconds.

(32) Using the multimeter, connect leads be-tween black terminal (+) and red terminal (-) on dc motor 2B1.

(33) While observing multimeter on ____ vdc range, set switch S2 on test cable to position 4 (15°L). The multimeter should indicate from ____ to ____ volts dc for a maximum of 20 seconds.

(34) Using the multimeter on ____ vdc range, connect leads between red terminal (+) and black terminal (-) on dc motor 2B1.

(35) While observing multimeter, set switch S2 on test cable to position 3 (15°R). The mul-timeter should indicate from ____ to ____ volts dc for a maximum of 20 seconds.

(36) Set switch S2 on test cable to position 2 (90° vertical). Using a grease pencil, index pinion gear on output shaft of 430 to 1 gearbox to housing.

(37) While observing pinion gear, set switch S2 on test cable to position 6 (30°R). Pinion gear should rotate counterclockwise two complete revolutions.

(38) While observing pinion gear, set switch S2 on test cable to position 3 (15°R). Pinion gear should rotate counterclockwise one-half revolution.

(39) While observing pinion gear, set switch S2 on test cable to position 5 (30°L). The pinion gear should rotate clockwise four-and one-half revolutions.

(40) While observing pinion gear, set switch S2 on test cable to position 4 (15°L). The pinion gear should rotate clockwise one-half revolution.

NOTE

Procedures in steps (41) through (48), check the operation of limit switch 2S1. These procedures, if accomplished, will require adjustment of potentiometer 2R6 (refer to para 5–55*c*(1)) after completion.

(41) Using a grease pencil, index shaft of potentiometer 2R6 to rotary mount actuator housing.

CAUTION

Limit switch 2S1 should operate, stopping dc motor 2B1 after 2° of clockwise pinion gear rotation. If it appears that limit switch 2S1 is not functioning properly by allowing more than 2° clockwise rotation of the pinion gear, do not continue adjustment of potentiometer 2R6. Further adjustment of potentiometer 2R6 will cause followup potentiometer 2R3 to be overdriven.

(42) While observing pinion gear, loosen potentiometer 2R6 locknut and slowly adjust potentiometer as to cause the pinion gear to rotate clockwise approximately 2°. Further adjustment of potentiometer 2R6 should cause further clockwise rotation of pinion gear.

(43) Adjust potentiometer 2R6 until index mark on shaft is coincident with index mark on rotary mount actuator housing.

(44) Set switch S2 on test cable to position 3 (15°R).

CAUTION

Limit switch 2S1 should operate, stopping dc motor 2B1 rotation after 2° of counterclockwise pinion gear rotation. If it appears that limit switch 2S1 is not functioning properly by allowing more than a 2° counterclockwise rotation of the pinion gear, do not continue adjustment of potentiometer 2R6. Further adjustment of potentiometer 2R6 will cause followup potentiometer 2R3 to be overdriven.

(45) While observing pinion gear, slowl adjust potentiometer 2R6 as to cause the pinio gear to rotate counterclockwise approximately 2° Further adjustment of potentiometer 2R6 shoul not cause further counterclockwise rotation c pinion gear.

(46) Adjust potentiometer 2R6 until inde mark on shaft is coincident with index mark o rotary mount actuator housing.

(47) Tighten locknut on potentiometer 2R shaft.

(48) Refer to paragraph 5–55*c*(1) for poter tiometer 2R6 adjustment procedures.

(49) Set switches S1 and S2 on test cable t off position.

(50) Turn ac and dc power sources off.

(51) Disconnect test setup.

Figure 5–21. Rotary mount actuator, waveforms.
(Illustration not available for publication)

b. Troubleshooting Chart. Steps reference in *Trouble symptom* column refer to numbere subparagraphs in the operational check (*a* above Electronic parts and associated circuitry refe enced in the troubleshooting chart are shown i the schematic diagram (fig. 5–22) and wirin diagrams (figs. 5–23 and 5–24).

CAUTION

This equipment is transistorized. Use multimeter RX100 ohms range to measure circuit resistances, thereby preventing possible damage or destruction to transistors due to excessive current.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Ac voltmeter, when connected between terminals 2 and 4 on transformer 2T3, does not indicate from 113.7 to 117.3 volts ac (step 7).	*a.* Defective filter 2FL1	*a.* Check filter and replace if defective.
		b. Defective transformer 2T3	*b.* Check transformer and replace if defective.
		c. Defective capacitor 2C4	*c.* Check capacitor and replace if defective.
		d. Defective capacitor 2C5	*d.* Check capacitor and replace if defective.

No.	Trouble symptom	Probable cause	Checks and corrective measures
		e. Defective wiring	*e.* Check for continuity between pin K of connector 2P1 and filter 2FL1 input. Check for continuity between pin M of connector 2P1 and filter 2FL1 input. Check for continuity between terminal 2 on filter 2FL1 and terminal 2 on transformer 2T3. Check for continuity between terminal 1 on filter 2FL1 and terminal 4 on transformer 2T3. Repair or replace wiring if defective.
	Ac voltmeter, when connected between terminals 1 and 3 on transformer 2T3, does not indicate from 113.7 to 117.3 volts ac (step 7).	*a.* Defective capacitor 2C6	*a.* Check capacitor and replace if defective.
		b. Defective transformer 2T3	*b.* Check transformer and replace if defective.
	Ac voltmeter, when connected between terminals 3 and 5 on transformer 2T3, does not indicate from 113.7 to 117.3 volts ac (step 7).	*a.* Defective capacitor 2C9	*a.* Check capacitor and replace if defective.
		b. Defective transformer 2T3	*b.* Check transformer and replace if defective.
	Ac voltmeter, when connected between terminals 6 and 8 on transformer 2T3, does not indicate from 9.21 to 9.59 volts ac (step 7).	Defective transformer 2T3	Check transformer and replace if defective.
	Ac voltmeter, when connected between terminals 8 and 10 on transformer 2T3, does not indicate from 9.21 to 9.59 volts ac (step 7).	Defective transformer 2T3	Check transformer and replace if defective.
	Ac voltmeter, when connected between terminals 7 and 8 on transformer 2T3, does not indicate from 3.36 to 5.04 volts ac (step 7).	Defective transformer 2T3	Check transformer and replace if defective.
	Ac voltmeter, when connected between terminals 8 and 9 on transformer 2T3, does not indicate from 3.36 to 5.04 volts ac (step 7).	Defective transformer 2T3	Check transformer and replace if defective.
	Ac voltmeter, when connected between terminals 11 and 12 on transformer 2T3, does not indicate from 76.44 to 79.56 volts ac (step 7).	Defective transformer 2T3	Check transformer and replace if defective.
	Multimeter does not indicate from +10.8 to +13.2 volts dc (step 8).	*a.* Defective diode 2A1CR2	*a.* Check diode and replace if defective.
		b. Defective diode 2A1CR7	*b.* Check diode and replace if defective.
		c. Defective capacitor 2A1C1	*c.* Check capacitor and replace if defective.
		d. Defective capacitor 2A1C13	*d.* Check capacitor and replace if defective.
	Multimeter does not indicate from –5.4 to –6.6 volts dc (step 9).	*a.* Defective diode 2A1CR3	*a.* Check diode and replace if defective.
		b. Defective diode 2A1CR4	*b.* Check diode and replace if defective.
		c. Defective capacitor 2A1C2	*c.* Check capacitor and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		d. Defective capacitor 2A1C14	*d.* Check capacitor and replace if defective.
11	Multimeter does not indicate from +8.1 to +9.9 volts dc (step 10).	*a.* Defective Zener diode 2A1CR1	*a.* Check Zener diode and replace if defective.
		b. Defective resistor 2A1R3	*b.* Check resistor for 200 ±10 ohms resistance. If necessary, replace defective resistor.
12	Multimeter does not indicate from –4.6 to –5.6 volts dc (step 11).	*a.* Defective zener diode 2A1CR25	*a.* Check zener diode and replace if defective.
		b. Defective resistor 2A1R18	*b.* Check resistor for 33 ±2 ohms resistance. If necessary, replace defective resistor.
13	Oscilloscope display abnormal (step 12).	*a.* Defective zener diode 2A1CR5	*a.* Check zener diode and replace if defective.
		b. Defective resistor 2A1R6	*b.* Check resistor for 5100 ±255 ohms resistance. If necessary, replace defective resistor.
		c. Defective diode 2A1CR8	*c.* Check diode and replace if defective.
		d. Defective capacitor 2A1C11	*d.* Check capacitor and replace if defective.
		e. Defective transistor 2A1Q4	*e.* Check transistor and replace if defective.
14	Oscilloscope display is abnormal (step 13).	*a.* Defective Zener diode 2A1CR6	*a.* Check Zener diode and replace if defective.
		b. Defective resistor 2A1R7	*b.* Check resistor for 5100 ±255 ohms resistance. If necessary, replace defective resistor.
		c. Defective diode 2A1CR9	*c.* Check diode and replace if defective.
		d. Defective capacitor 2A1C12	*d.* Check capacitor and replace if defective.
		e. Defective transistor 2A1Q5	*e.* Check transistor and replace if defective.
15	Multimeter does not indicate from +180 to +220 volts dc (step 14).	*a.* Defective diode(s) 2CR1 through 2CR4.	*a.* Check diode(s) and replace if defective.
		b. Defective resistor 2R1	*b.* Check resistor for 10,000 ±500 ohms resistance. If necessary, replace defective resistor.
		c. Defective resistor 2R2	*c.* Check resistor for 100 ±5 ohms resistance. If necessary, replace defective resistor.
		d. Defective capacitor 2C1	*d.* Check capacitor and replace if defective.
		e. Defective capacitor 2A1C3	*e.* Check capacitor and replace if defective.
		f. Defective capacitor 2A1C7	*f.* Check capacitor and replace if defective.
		g. Defective potentiometer 2R3	*g.* Check potentiometer for 50,000 ±2,500 ohms resistance. If necessary replace defective potentiometer.
16	Multimeter, when connected between terminals A (+) and C (–) of TB1 on test cable, does not indicate from –80 to –86 volts dc (step 15).	*a.* Defective potentiometer 2R3	*a.* Check between terminals 4 and 6 on potentiometer for 20, 830 ±1,045 ohms resistance. If necessary, replace defective potentiometer.
		b. Defective wiring	*b.* Check for continuity between pin c of connector 2P1 and terminal 4 on potentiometer 2R3. Check for continuity between pin A of connector 2P1 and terminal 6 on potentiometer 2R3. Repair or replace wiring if defective.

n No.	Trouble symptom	Probable cause	Checks and corrective measures
	Multimeter, when connected between terminals A (+) and D (–) of TB1 on test cable, does not indicate from –63 to –69 volts dc (step 15).	*a.* Defective potentiometer 2R3	*a.* Check between terminals 5 and 6 on potentiometer for 1670 ±80 ohms resistance. If necessary, replace defective potentiometer.
		b. Defective wiring	*b.* Check for continuity between pin D of connector 2P1 and terminal 5 on potentiometer 2R3. Repair or replace wiring if defective.
	Multimeter, when connected between terminals B (+) and A (–) of TB1 on test cable, does not indicate from +80 to +86 volts dc (step 15).	*a.* Defective potentiometer 2R3	*a.* Check between terminals 8 and 6 on potentiometer for 20,830 ±1,045 ohms resistance. If necessary, replace defective potentiometer.
		b. Defective wiring	*b.* Check for continuity between pin B of connector 2P1 and terminal 8 on potentiometer 2R3. Repair or replace wiring if defective.
	Multimeter, when connected between terminals E (+) and A (–) of TB1 on test cable, does not indicate from +63 to +69 volts dc (step 15).	*a.* Defective potentiometer 2R3	*a.* Check between terminals 6 and 7 on potentiometer for 1670 ±80 ohms resistance. If necessary, replace defective potentiometer.
		b. Defective wiring	*b.* Check for continuity between pin E of connector 2P1 and terminal 7 on potentiometer 2R3. Repair or replace wiring if defective.
	Indicator lamp DS1 on test cable does not light (step 16).	*a.* Defective amplifier 2A1AR1 or associated circuitry.	*a.* Check for –0.5 ±0.005 volt dc at terminal 7 on amplifier 2A1AR1. If –0.5 ±0.005 volt dc is not obtained, amplifier 2A1AR1 or associated circuitry is defective. If necessary, replace defective amplifier or circuit parts.
		b. Defective amplifier 2A1AR4 or associated circuitry.	*b.* Check for –0.5 ±0.005 volt dc at terminal 7 on amplifier 2A1AR4. If –0.5 ±0.005 volt dc is not obtained, amplifier 2A1AR4 or associated circuitry is defective. If necessary, replace defective amplifier 2A1AR4 or circuit parts.
		c. Defective transistor 2A1Q7	*c.* Check transistor and replace if defective.
		d. Defective resistor 2A1R43	*d.* Check resistor for 3000 ±150 ohms resistance. If necessary, replace defective resistor.
		e. Defective transistor 2A1Q8	*e.* Check transistor and replace if defective.
		f. Defective resistor 2A1R41	*f.* Check resistor for 33 ±2 ohms resistance. If necessary, replace defective resistor.
		g. Defective wiring	*g.* Check for continuity between pin N of connector 2P1 and terminal E12 on module 2A1. Repair or replace wiring if defective.
	Oscilloscope display is abnormal (step 17).	*a.* Defective amplifier 2A1AR2	*a.* Check for –0.5 ±0.005 volt dc at terminal 7 on amplifier 2A1AR2. If –0.5 ±0.005 volt dc is not obtained, amplifier 2A1AR2 or associated circuitry is defective. If necessary, replace defective amplifier or circuit parts.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		b. Defective amplifier 2A1AR3 or associated circuitry.	*b.* Check for –0.5 ±0.005 volt dc at terminal 7 on amplifier 2A1AR3. If –0.5 ±0.005 volt dc is not obtained, amplifier 2A1AR3 or associated circuitry is defective. If necessary, replace defective amplifier or circuit parts.
		c. Defective multivibrator 2A1Q10 and 2A1Q11.	*c.* Check transistor(s) and associated multivibrator parts. If necessary, replace any defective parts.
		d. Defective resistor 2A1R34	*d.* Check resistor for 10,000 ±500 ohms resistance. If necessary, replace defective resistor.
		e. Defective resistor 2A1R43	*e.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		f. Defective resistor 2A1R29	*f.* Check resistor for 2,000 ±100 ohms resistance. If necessary, replace defective resistor.
		g. Defective transistor 2A1Q9	*g.* Check transistor and replace if defective.
22	Multimeter does not indicate from +10.8 to +13.2 volts dc (step 18).	*a.* Defective resistor 2A1R35	*a.* Check resistor for 3,900 ±195 ohms resistance. If necessary, replace defective resistor.
		b. Defective transistor 2A1Q14	*b.* Check transistor and replace if defective.
23	Multimeter does not indicate from +10.8 to +13.2 volts dc (step 19).	*a.* Defective resistor 2A1R17	*a.* Check resistor for 3,900 ±195 ohms resistance. If necessary, replace defective resistor.
		b. Defective transistor 2A1Q1	*b.* Check transistor and replace if defective.
24	Oscilloscope display abnormal (step 20).	*a.* Defective transistor 2A1Q4	*a.* Check transistor and replace if defective.
		b. Defective transistor 2A1Q5	*b.* Check transistor and replace if defective.
		c. Defective resistor 2A1R20	*c.* Check resistor for 30,000 ±1,500 ohms resistance. If necessary, replace defective resistor.
		d. Defective capacitor 2A1C5	*d.* Check capacitor and replace if defective.
		e. Defective diode 2A1CR12	*e.* Check diode and replace if defective.
		f. Defective resistor 2A1R21	*f.* Check resistor for 15,000 ±750 ohms resistance. If necessary, replace defective resistor.
		g. Defective resistor 2A1R22	*g.* Check resistor for 2,000 ±100 ohms resistance. If necessary, replace defective resistor.
		h. Defective transistor 2A1Q6	*h.* Check transistor and replace if defective.
25	Multimeter does not indicate from –5.4 to –6.6 volts dc (step 21).	*a.* Defective diode 2A1CR20	*a.* Check diode and replace if defective.
		b. Defective resistor 2A1R38	*b.* Check resistor for 560 ±25 ohms resistance. If necessary, replace defective resistor.
		c. Defective resistor 2A1R45	*c.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		d. Defective transistor 2A1Q12	*d.* Check transistor and replace if defective.
		e. Defective resistor 2A1R26	*e.* Check resistor for 510 ±5 ohms resistance. If necessary, replace defective resistor.

No.	Trouble symptom	Probable cause	Checks and corrective measures
		f. Defective resistor 2A1R39	*f.* Check resistor for 1,500 ±75 ohms resistance. If necessary, replace defective resistor.
		g. Defective capacitor 2A1C10	*g.* Check capacitor and replace if defective.
		h. Defective unijunction in transistor 2A1Q13.	*h.* Check unijunction transistor and replace if defective.
	Multimeter does not indicate from -5.4 to -6.6 volts dc (step 22).	*a.* Defective diode 2A1CR13	*a.* Check diode and replace if defective.
		b. Defective resistor 2A1R14	*b.* Check resistor for 560 ±25 ohms resistance. If necessary, replace defective resistor.
		c. Defective resistor 2A1R11	*c.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		d. Defective transistor 2A1Q2	*d.* Check transistor and replace if defective.
		e. Defective resistor 2A1R23	*e.* Check resistor for 510 ±25 ohms resistance. If necessary, replace defective resistor.
		f. Defective resistor 2A1R12	*f.* Check resistor for 1,500 ±75 ohms resistance. If necessary, replace defective resistor.
		g. Defective capacitor 2A1C3	*g.* Check capacitor and replace if defective.
		h. Defective unijunction transistor 2A1Q3.	*h.* Check unijunction transistor and replace if defective.
	Indicator lamp DS1 on test cable does not light (step 23).	*a.* Defective dc motor and brake 2B1 and/or 430 to 1 gearbox.	*a.* Check for positive or negative 103 ±10.3 volts dc between terminal 3 on 2T3 and red terminal on dc motor 2B1. If voltage indication is obtained, dc motor and brake and/or 430 to 1 gearbox is defective. If necessary, repair or replace defective dc motor and brake and/or 430 to 1 gearbox. *Note.* In following test, if dc motor operates in either or both positions 3 and 4 of switch set switch S2 to position 2 (90°, vertical) and proceed with step 24 of operational check *a* above) to further isolate the malfunction.
		b. Defective limit switch 2S1, 430 to 1 gearbox, or followup potentiometer 2R3.	*b.* Set switch S2 on test cable to position 3 and wait 20 seconds. Then, set switch S2 on test cable to position 4 (15°L) and wait 20 seconds. If dc motor did not operate in either S2 switch position, limit switch 2S1, 430 to 1 gearbox, or followup potentiometer are defective. If necessary, repair or replace defective part(s).
	Multimeter does not indicate from +10.8 to +13.2 volts dc (step 24).	*a.* Defective diode 2A1CR17	*a.* Check diode and replace if defective.
		b. Defective transistor 2A1Q12	*b.* Check transistor and replace if defective.
		c. Defective resistor 2A1R27	*c.* Check resistor for 820 ±40 ohms resistance. If necessary, replace defective resistor.
		d. Defective unijunction transistor 2A1Q13.	*d.* Check unijunction transistor and replace if defective.
		e. Defective diode 2CR5	*e.* Check diode and replace if defective.
		f. Defective transformer 2T1	*f.* Check transformer and replace if defective.
		g. Defective silicon-controlled rectifier 2CR7.	*g.* Check silicon-controlled rectifier and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		h. Defective silicon-controlled rectifier 2CR8.	*h.* Check silicon-controlled rectifier and replace if defective.
		i. Defective limit switch 2S1	*i.* Check limit switch and replace if defective.
		j. Rotary mount actuator requires adjustment.	*j.* Perform adjustment; refer to paragraph 5-55*c*.
29	Multimeter does not momentarily indicate from 0 to +0.6 volt dc (step 25).	*a.* Defective Zener diode 2ACR21	*a.* Check Zener diode and replace if defective.
		b. Defective capacitor 2A1C4	*b.* Check capacitor and replace if defective.
		c. Defective resistor 2A1R48	*c.* Check resistor for 1,000 ±50 ohms resistance. If necessary, replace defective resistor.
		d. Defective potentiometer 2A1R42	*d.* Check potentiometer for 2,500 ±125 ohms resistance. If necessary, replace defective potentiometer.
		e. Defective resistor 2A1R46	*e.* Check resistor for 3,240 ±160 ohms resistance. If necessary, replace defective resistor.
		f. Defective capacitor 2A1C15	*f.* Check capacitor and replace if defective.
		g. Defective resistor 2A1R40	*g.* Check resistor for 10,000 ±500 ohm resistance. If necessary, replace defective resistor.
		h. Defective resistor 2A1R47	*h.* Check resistor for 249 ±10 ohms resistance. If necessary, replace defective resistor.
		i. Defective amplifier 2A1AR4	*i.* Check amplifier and replace if defective.
		j. Defective resistor 2A1R44	*j.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		k. Defective transistor 2A1Q14	*k.* Check transistor and replace if defective.
30	Indicator lamp DS1 on test cable does not momentarily go out (step 25).	*a.* Defective diode 2A1CR19	*a.* Check diode and replace if defective.
		b. Defective resistor 2A1R16	*b.* Check resistor for 1,000 ±50 ohms resistance. If necessary, replace defective resistor.
		c. Defective resistor 2A1R13	*c.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		d. Defective transistor 2A1Q7	*d.* Check transistor and replace if defective.
		e. Defective transistor 2A1Q8	*e.* Check transistor and replace if defective.
31	Multimeter does not indicate from +10.8 to +13.2 volts dc after 20 seconds (maximum). Indicator lamp DS1 on test cable does not light (step 25).	*a.* Defective diode 2A1CR17	*a.* Check diode and replace if defective
		b. Defective transistor 2A1Q12	*b.* Check transistor and replace if defective.
		c. Defective resistor 2A1R27	*c.* Check resistor for 820 ±40 ohms resistance. If necessary, replace defective resistor.
		d. Defective unijunction transistor 2A1Q13.	*d.* Check unijunction transistor and replace if defective.
		e. Defective diode 2CR5	*e.* Check diode and replace if defectiv
		f. Defective transformer 2T1	*f.* Check transformer and replace if defective.
		g. Defective silicon-controlled rectifier 2CR7.	*g.* Check silicon-controlled rectifier and replace if defective.
		h. Defective silicon-controlled rectifier 2CR8.	*h.* Check silicon-controlled rectifier an replace if defective.
		i. Defective limit switch 2S1	*i.* Check limit switch and replace if defective.

m No.	Trouble symptom	Probable cause	Checks and corrective measures
		j. Defective dc motor and brake 2B1	*j.* Check dc motor and brake and replace if defective.
		k. Detective 430 to 1 gearbox	*k.* Check 430 to 1 gearbox and replace if defective.
		l. Defective followup potentiometer 2R3.	*l.* Check mechanical operation of followup potentiometer and replace if defective.
		m. Rotary mount actuator requires adjustment.	*m.* Perform adjustment; refer to paragraph 5–55*c*.
2	Multimeter does not indicate from +10.8 to +13.2 volts dc after a period of more than 20 seconds. Indicator lamp DS1 on test cable requires more than 20 seconds to light (step 25).	*a.* Defective resistor 2A1R15	*a.* Check resistor for 1690 ±85 ohms resistance. If necessary, replace defective resistor.
		b. Defective potentiometer 2A1R25	*b.* Check potentiometer for 2,500 ±125 ohms resistance. If necessary, replace defective potentiometer.
		c. Defective resistor 2A1R32	*c.* Check resistor for 10,000 ±500 ohms resistance. If necessary, replace defective resistor.
		d. Defective resistor 2A1R33	*d.* Check resistor for 634 ±30 ohms resistance. If necessary, replace defective resistor.
		e. Defective amplifier 2A1AR3	*e.* Check amplifier and replace if defective.
		f. Defective diode 2A1CR16	*f.* Check diode and replace if defective.
		g. Defective resistor 2A1R28	*g.* Check resistor for 1,000 ±50 ohms resistance. If necessary, replace defective resistor.
		h. Defective diode 2A1CR18	*h.* Check diode and replace if defective.
		i. Defective dc motor and brake 2B1	*i.* Check dc motor and brake and replace if defective.
		j. Defective 430 to 1 gearbox	*j.* Check 430 to 1 gearbox and replace if defective.
		k. Rotary mount actuator requires adjustment.	*k.* Perform adjustment; refer to paragraph 5–55*c*.
3	Multimeter does not indicate from +10.8 to +13.2 volts dc (step 26).	*a.* Defective diode 2A1CR14	*a.* Check diode and replace if defective.
		b. Defective transistor 2A1Q2	*b.* Check transistor and replace if defective.
		c. Defective resistor 2A1R24	*c.* Check resistor for 820 ±40 ohms resistance. If necessary, replace defective resistor.
		d. Defective unijunction transistor 2A1Q3.	*d.* Check unijunction transistor and replace if defective.
		e. Defective diode 2CR6	*e.* Check diode and replace if defective.
		f. Defective transformer 2T2	*f.* Check transformer 2T2 and replace if defective.
		g. Defective silicon-controlled rectifier 2CR9.	*g.* Check silicon-controlled rectifier and replace if defective.
		h. Defective silicon-controlled rectifier 2CR10.	*h.* Check silicon-controlled rectifier and replace if defective.
		i. Defective limit switch 2S1	*i.* Check limit switch and replace if defective.
		j. Rotary mount actuator requires adjustment.	*j.* Perform adjustment; refer to paragraph 5–55*c*.
4	Multimeter does not indicate from 0 to +0.6 volt dc (step 27).	*a.* Defective zener diode 2A1CR24	*a.* Check Zener diode and replace if defective.
		b. Defective resistor 2A1R4	*b.* Check resistor for 140 ±5 ohms resistance. If necessary, replace defective resistor.
		c. Defective resistor 2A1R5	*c.* Check resistor for 10,000 ±500 ohms resistance. If necessary, replace defective resistor.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
		d. Defective amplifier 2A1AR1	*d.* Check amplifier and replace if defective.
		e. Defective resistor 2A1R10	*e.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		f. Defective transistor 2A1Q1	*f.* Check transistor and replace if defective.
35	Indicator lamp DS1 on test cable does not momentarily go out (step 27).	Defective diode 2A1CR11	Check diode and replace if defective.
36	Multimeter does not indicate from +10.8 to +13.2 volts dc after 20 seconds (maximum). Indicator lamp DS1 on test cable does not light (step 27).	*a.* Defective diode 2A1CR14	*a.* Check diode and replace if defective.
		b. Defective transistor 2A1Q2	*b.* Check transistor and replace if defective.
		c. Defective resistor 2A1R24	*c.* Check resistor for 820 ±40 ohms resistance. If necessary, replace defective resistor.
		d. Defective unijunction transistor 2A1Q3.	*d.* Check unijunction transistor and replace if defective.
		e. Defective diode 2CR6	*e.* Check diode and replace if defective.
		f. Defective transformer 2T2	*f.* Check transformer and replace if defective.
		g. Defective silicon-controlled 2CR9	*g.* Check silicon-controlled rectifier and replace if defective.
		h. Defective silicon-controlled rectifier 2CR10.	*h.* Check silicon-controlled rectifier and replace if defective.
		i. Defective limit switch 2S1	*i.* Check limit switch and replace if defective.
		j. Defective dc motor and brake 2B1	*j.* Check dc motor and brake and replace if defective.
		k. Defective 430 to 1 gearbox	*k.* Check 430 to 1 gearbox and replace if defective.
		l. Defective followup potentiometer 2R3.	*l.* Check mechanical operation of potentiometer and replace if defective.
		m. Rotary mount actuator requires adjustment.	*m.* Perform adjustment; refer to paragraph 5-55*c*.
37	Multimeter does not indicate from +10.8 to +13.2 volts dc after a period of more than 20 seconds. Indicator lamp DS1 on test cable requires more than 20 seconds to light (step 27).	*a.* Defective resistor 2A1R8	*a.* Check resistor for 10,000 ±500 ohms resistance. If necessary, replace defective resistor.
		b. Defective resistor 2A1R9	*b.* Check resistor for 348 ±15 ohms resistance. If necessary, replace defective resistor.
		c. Defective amplifier 2A1AR2	*c.* Check amplifier and replace if defective.
		d. Defective diode 2A1CR10	*d.* Check diode and replace if defective.
		e. Defective diode 2A1CR15	*e.* Check diode and replace if defective.
		f. Defective dc motor and brake 2B1	*f.* Check dc motor and brake and replace if defective.
		g. Defective 430 to 1 gearbox	*g.* Check 430 to 1 gearbox and replace if defective.
		h. Rotary mount actuator requires adjustment.	*h.* Perform adjustment; refer to paragraph 5-55*c*.
38	Oscilloscope display abnormal (step 29).	*a.* Defective diode 2A1CR17	*a.* Check diode and replace if defective.
		b. Defective resistor 2A1R38	*b.* Check resistor for 560 ±25 ohms resistance. If necessary, replace defective resistor.
		c. Defective resistor 2A1R45	*c.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		d. Defective transistor 2A1Q12	*d.* Check transistor and replace if defective.

n No.	Trouble symptom	Probable cause	Checks and corrective measures
		e. Defective resistor 2A1R39	*e.* Check resistor for 1,500 ±75 ohms resistance. If necessary, replace defective resistor.
		h. Defective capacitor 2A1C9	*h.* Check capacitor and replace if defective.
		i. Defective capacitor 2A1C10	*i.* Check capacitor and replace if defective.
		j. Defective unijunction transistor 2A1Q13.	*j.* Check unijunction transistor and replace if defective.
		k. Defective diode 2CR5	*k.* Check diode and replace if defective.
		l. Defective transformer 2T1	*l.* Check transformer and replace if defective.
9	Oscilloscope display abnormal (step 31).	*a.* Defective diode 2A1CR14	*a.* Check diode and replace if defective.
		b. Defective resistor 2A1R14	*b.* Check resistor for 560 ±25 ohms resistance. If necessary, replace defective resistor.
		c. Defective resistor 2A1R11	*c.* Check resistor for 5,100 ±255 ohms resistance. If necessary, replace defective resistor.
		d. Defective transistor 2A1Q2	*d.* Check transistor and replace if defective.
		e. Defective resistor 2A1R12	*e.* Check resistor for 1,500 ±75 ohms resistance. If necessary, replace defective resistor.
		f. Defective resistor 2A1R23	*f.* Check resistor for 510 ±25 ohms resistance. If necessary, replace defective resistor.
		g. Defective resistor 2A1R24	*g.* Check resistor for 820 ±40 ohms resistance. If necessary, replace defective resistor.
		h. Defective capacitor 2A1C6	*h.* Check capacitor and replace if defective.
		i. Defective capacitor 2A1C3	*i.* Check capacitor and replace if defective.
		j. Defective unijunction transistor 2A1Q3.	*j.* Check unijunction transistor and replace if defective.
		k. Defective diode 2CR6	*k.* Check diode and replace if defective.
		l. Defective transformer 2T2	*l.* Check transformer and replace if defective.
0	Multimeter does not indicate from ______ to ______ volts dc (step 33).	*a.* Defective transformer 2T1	*a.* Check transformer and replace if defective.
		b. Defective silicon-controlled rectifier 2CR7.	*b.* Check silicon-controlled rectifier and replace if defective.
		c. Defective silicon-controlled rectifier 2CR8.	*c.* Check silicon-controlled rectifier and replace if defective.
		d. Defective limit switch 2S1	*d.* Check limit switch and replace if defective.
		e. Defective dc motor and brake 2B1	*e.* Check dc motor and brake and replace if defective.
1	Multimeter does not indicate from ______ to ______ volts dc (step 35).	*a.* Defective transformer 2T2	*a.* Check transformer and replace if defective.
		b. Defective silicon-controlled rectifier 2CR9.	*b.* Check silicon-controlled rectifier and replace if defective.
		c. Defective silicon-controlled rectifier 2CR10.	*c.* Check silicon-controlled rectifier and replace if defective.
		d. Defective limit switch 2S1	*d.* Check limit switch and replace if defective.
[illegible]	Pinion gear does not rotate counterclockwise two revolutions (step 37).	*a.* Defective 430 to 1 gearbox	*a.* Check 430 to 1 gearbox and replace if defective.
		b. Defective dc motor 2B1	*b.* Check dc motor and replace if defective.

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
43	Pinion gear does not rotate counterclockwise one-half revolution (step 38).	*a.* Defective 430 to 1 gearbox *b.* Defective dc motor 2B1	*a.* Check 430 to 1 gearbox and replace if defective. *b.* Check dc motor and replace if defective.
44	Pinion gear does not rotate clockwise four and one-half revolutions (step 39).	*a.* Defective 430 to 1 gearbox *b.* Defective dc motor 2B1	*a.* Check 430 to 1 gearbox and replace if defective. *b.* Check dc motor and replace if defective.
45	Pinion gear does not rotate clockwise one-half revolution (step 40).	*a.* Defective 430 to 1 gearbox *b.* Defective dc motor 2B1	*a.* Check 430 to 1 gearbox and replace if defective. *b.* Check dc motor and replace if defective.
46	Pinion gear rotates further than 2° clockwise (step 42).	Defective limit switch 2S1	Check limit switch and replace if defective.
47	Pinion gear rotates further than 2° counterclockwise (step 45).	Defective limit switch 2S1	Check limit switch and replace if defective.

c. Voltage and Resistance (V & R) Measurement.

(1) *Voltage measurements.* To perform voltage measurements on rotary mount actuator, proceed as follows:

NOTE

Remove cover from rotary mount actuator.

(*a*) Set switches S1 and S2 on test cable to off position.

(*b*) Connect the connector J1 on test cable (fig. 5-20) to connector 2P1 on rotary mount actuator.

(*c*) Turn ac and dc power sources (fig. 5-20) on.

(*d*) Set switch S1 on test cable to on position. Allow 15 minutes to warmup.

(*e*) Using multimeter (dc voltages) and ac voltmeter (ac voltages), perform the voltage measurements on terminals as indicated below.

Voltmeter		Voltage
+	−	
2T3-2	2T3-4	112.7 to 117.3 vac
2T3-1	2T3-3	112.7 to 117.3 vac
2T3-5	2T3-3	112.7 to 117.3 vac
2T3-11	2T3-12	76.44 to 79.56 vac
2A1-E1	2A1-E3	9.21 to 9.59 vac
2A1-E2	2A1-E3	3.36 to 5.04 vac
2A1-E4	2A1-E3	3.36 to 5.04 vac
2A1-E5	2A1-E3	112.7 to 117.3 vac
2A1-E6	2A1-E3	-- to -- vdc
2A1-E3	2A1-E7	-- to -- vdc
2A1-E3	2A1-E8	-- to --
2A1-E10	2A1-E3	0.0 vdc
2A1-E3	2A1-E11	-- to -- vdc
2A1-E12	2A1-E3	0.0 to +0.6 vdc
2A1-E14	2A1-E3	-- to -- vdc

Voltmeter		Voltage
+	−	
2A1-E15	2A1-E3	-- to -- vdc
2A1-E3	2A1-E16	-- to -- vdc
2R3-3	2R3-1	-- to -- vdc
TB1-A	TB1-C	-- to -- vdc
TB1-A	TB-D	-- to -- vdc
TB1-B	TB1-A	-- to -- vdc
TB1-E	TB1-A	-- to -- vdc

(2) *Resistance measurements.* Note that this equipment is transistorized. The resistance measurements in the following chart are obtained with no power applied to the rotary mount actuator and with no external connections to connector 2P1. Using the multimeter, perform the resistance measurements on pins of connector 2P1 as indicated below.

Multimeter		Range	Resistance (ohms)
+	−		
J	L	RX1	0
A	L		
B	L		
C	L		
D	L		
E	L		
H	L		
K	L		
M	L		
N	L		
B	A	RX1,000	19,785 to 21,875
C	A	RX1,000	19,785 to 21,875
D	A	RX100	1,590 to 1,750
E	A	RX100	1,590 to 1,750

Figure 5-22. Rotary mount actuator, schematic diagram.
[Located in back of manual]

Figure 5-23. Rotary mount actuator, wiring diagram.
[Located in back of manual]

5-15. Door Actuator (Unit 4) Troubleshooting

The left, right and vertical door actuators are identical. General support troubleshooting procedures for the door actuator are given below.

a. Operational Check.

NOTE

The operation check of the door actuator consists of simulating various conditions and observign the results.

WARNING

Make sure that +28-volt dc power source is off before performing steps (1) through (3) below. Dangerous voltage of +28 volts dc are present on the clip when power is on.

(1) Fabricate test cable as shown in figure 5-25.

(2) Connect the connector P1 on test cable (fig. 5-25) to connector 4J1 on door actuator.

(3) Connect test cable (fig. 5-25) to +28-volt dc power source.

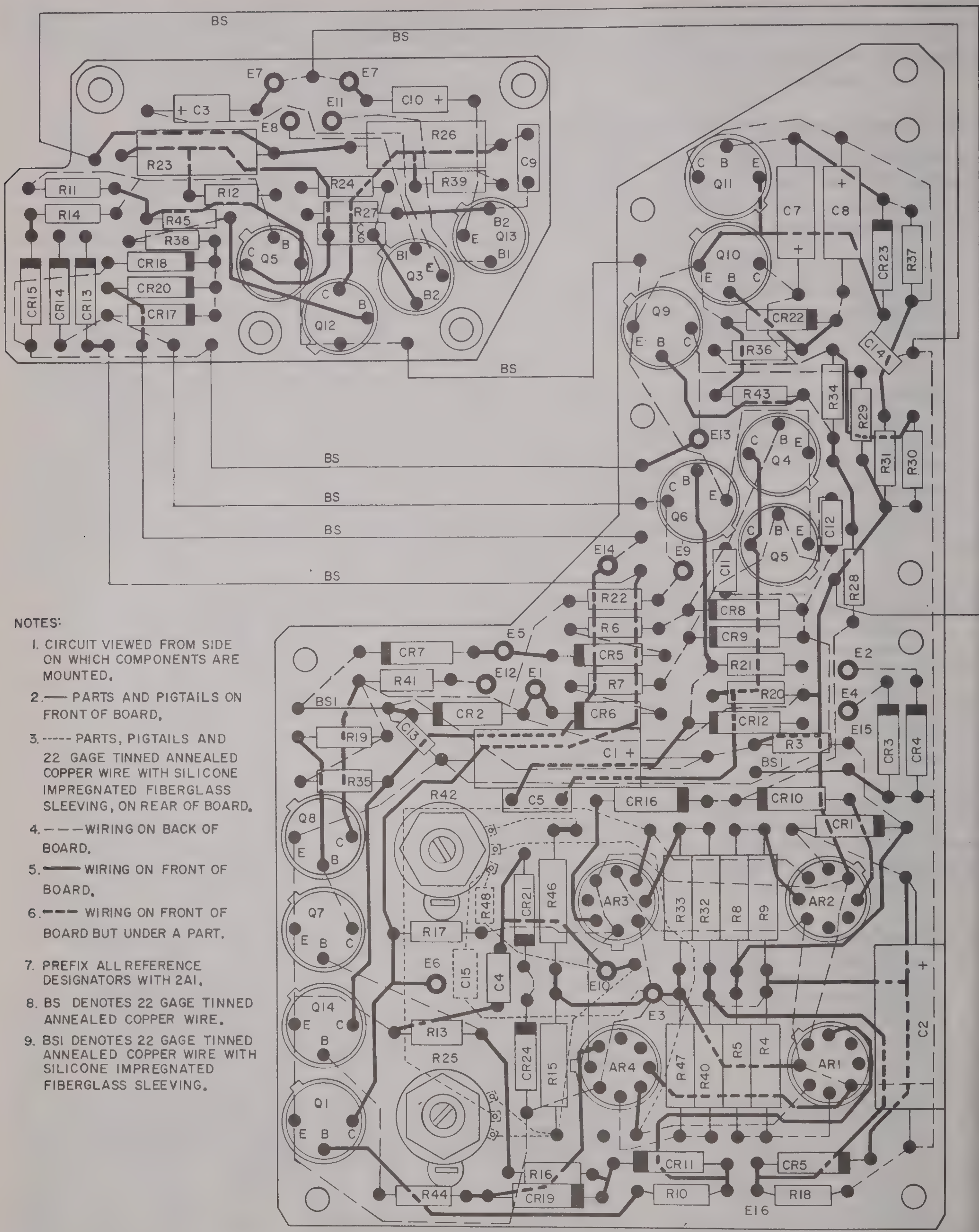
(4) Turn dc power source on. Allow 15 minutes for warmup.

(5) Momentarily connect clip to pin B of test cable connector P1 for 12 seconds. The door actuator shaft shall fully extend from 19.65 to 19.73 inches. The extend lamp DS1 should light and retract lamp DS2 on test cable should go out.

(6) Momentarily connect clip to pin A of test cable connector P1 for 12 seconds. The door actuator shaft shall fully retract from 13.71 to 13.79 inches. The retract lamp DS2 should light and extend lamp DS1 on test cable should go out.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 2-22).

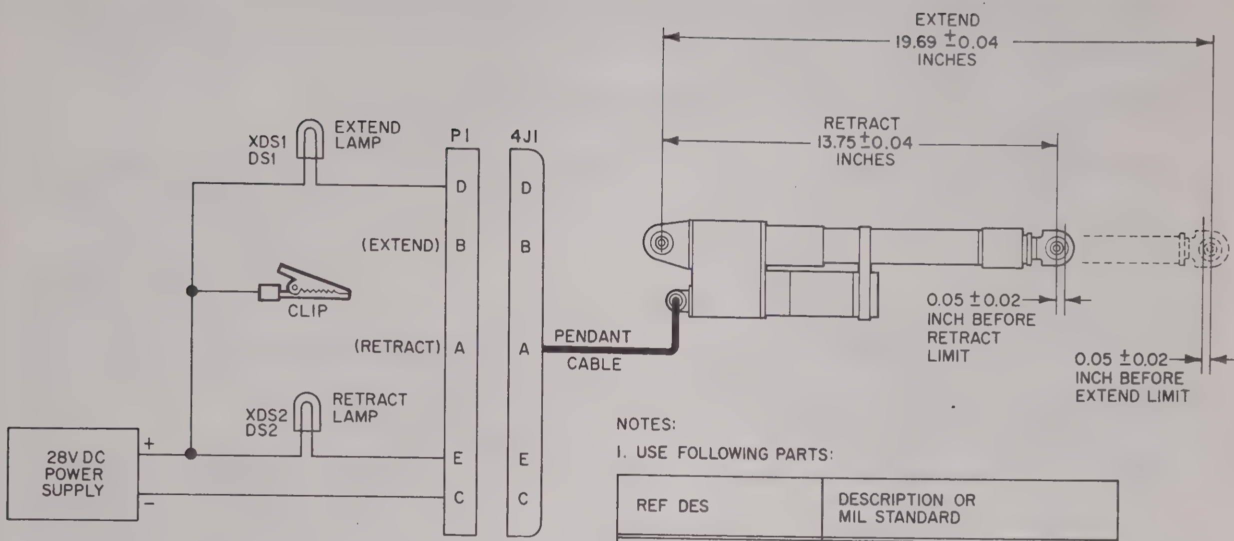
Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Door actuator shaft does not move and extend lamp DS1 on test cable does not light (step 5).	*a.* Defective extend limit switch(s) 4S1 and 4S2. *b.* Defective door close field coil *c.* Defective motor 4B1 *d.* Defective gear train	*a.* Check switch(s) and replace if defective. *b.* Check field coil and repair or replace motor if defective. *c.* Check motor and replace if defective. *d.* Check gear(s) and replace if defective.
2	Door actuator shaft does not fully extend from 19.65 to 19.73 inches and extend lamp DS1 on test cable does not light (step 5).	*a.* Extend limit switch(s) 4S1 and 4S2 not properly adjusted. *b.* Defective gear train	*a.* Adjust extend limit switch (refer to para 5-55*d* (3) and (4)). *b.* Check gear(s) and replace if defective.
3	Door actuator shaft does not move and retract lamp DS2 on test cable does not light (step 6).	*a.* Defective retract limit switch(s) 4S3 and 4S4. *b.* Defective door open field coil *c.* Defective motor 4B1 *d.* Defective gear train	*a.* Check switch(s) and replace if defective. *b.* Check field coil and repair or replace motor if defective. *c.* Check motor and replace if defective. *d.* Check gear(s) and replace if defective.
4	Door actuator shaft does not fully retract from 13.71 to 13.79 inches and retract lamp DS2 on test cable does not light (step 6).	*a.* Retract limit switch(s) 4S3 and 4S4 not properly adjusted. *b.* Defective gear train	*a.* Adjust retract limit switch (refer to para 5-55*d* (1) and (2)). *b.* Check gear(s) and replace if defective.



NOTES:

1. CIRCUIT VIEWED FROM SIDE ON WHICH COMPONENTS ARE MOUNTED.
2. —— PARTS AND PIGTAILS ON FRONT OF BOARD.
3. ----- PARTS, PIGTAILS AND 22 GAGE TINNED ANNEALED COPPER WIRE WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING, ON REAR OF BOARD.
4. – – – WIRING ON BACK OF BOARD.
5. ▬▬ WIRING ON FRONT OF BOARD.
6. ▬ ▬ ▬ WIRING ON FRONT OF BOARD BUT UNDER A PART.
7. PREFIX ALL REFERENCE DESIGNATORS WITH 2A1.
8. BS DENOTES 22 GAGE TINNED ANNEALED COPPER WIRE.
9. BS1 DENOTES 22 GAGE TINNED ANNEALED COPPER WIRE WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.

Figure 5-24. Rotary mount actuator module 2A1, wiring diagram.



NOTES:

1. USE FOLLOWING PARTS:

REF DES	DESCRIPTION OR MIL STANDARD
CLIP	TYPE TCI PER FED SPECIFICATION W-C-440
INDICATOR LIGHT XDS1, XDS2	MS25256-8
LAMP DS1, DS2	MS25237-327
CONNECTOR P1	MS3100A-14S-5P
WIRE	NO. 18 AWG

2. USE CONVIENT LENGHTS OF WIRE AS REQUIRED.
3. REFERENCE DESIGNATORS ARE ARBITRARILY ASSIGNED.

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Figure 5–25. Door actuator, cable fabrication diagram and test setup.

c. Voltage and Resistance (V & R) Measurements.

(1) *Voltage measurements.* Not applicable.

(2) *Resistance measurements.* The resistance measurements in the following chart are obtained with no power applied to the door actuator and with no external connection to connector 4J1. Using the multimeter, perform the resistance measurements on pins of connector 4J1 as indicated below.

NOTE

For extention or retraction of door actuator shaft refer to *a* above.

Multimeter +	Multimeter −	Range	Door actuator position	Resistance (ohms)
C	E	RX10,000	Ex tend	Infinite
C	A	RX1	Extend	4
C	B	RX10,000	Extend	Infinite
C	D	RX1	Extend	0
C	E	RX1	Retract	0
C	A	RX10,000	Retract	Infinite
C	B	RX1	Retract	4
C	D	RX10,000	Retract	Infinite

5–16. Light Sensor (Unit 5) Troubleshooting

The left, right, and vertical light sensors are identical. General support troubleshooting procedures for the light sensor are given below.

a. Operational Checks.

(1) Connect the light sensor, test equipment, and LS–80A as shown in figure 5–26.

NOTE

Refer to figure 5–13 for location of controls and indicators on LS–80A.

(2) Set all switches and controls on LS–80A to their OFF, neutral, of counterclockwise positions. Turn ac and dc power sources on.

(3) Set POWER switch (PANEL POWER section) on LS–80A to ON position. The AC PWR and DC PWR indicators (PANEL POWER section) on LS–80A, and the LS–233A should light. Allow 15 minutes for warmup.

(4) Set MASTER switch (MASTER section) on LS–80A to LENS CONE position.

(5) Set TEST switch (LENS CONE section) on LS–80A to PHOTO SENSOR position. The

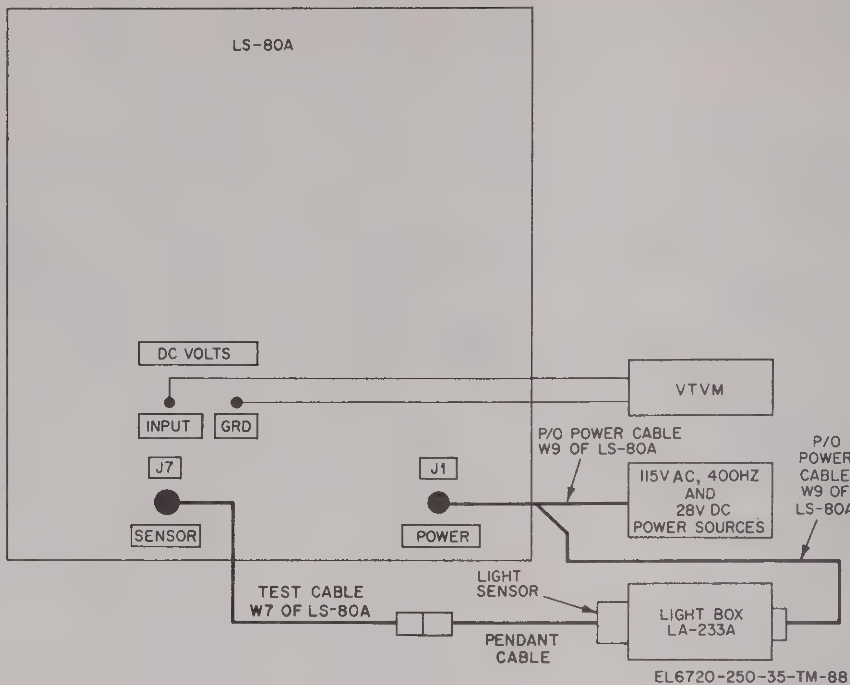


Figure 5-26. Light sensor, test setup.

DC VOLTS indicator (MASTER section) on LS-80A should light.

(6) Set EXP SIGNAL RANGE switch (LENS CONE section) on LS-80A to 0-10000 position.

(7) Place light sensor on light surface of LA-233A.

(8) Adjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A for a null indication on vtvm; the EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A should be from 1280 to 1920.

(9) Install 25 percent neutral density filter (PN 2998-933-1) between light sensor and light surface of LA-233A.

(10) Readjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A for a null indication on vtvm; the EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A should be from 320 to 480.

(11) Substitute 8.0 percent neutral density filter (PN 2998-933-2) for the 25 percent neutral density filter on LA-233A.

(12) Readjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A for a null indication on the vtvm; the EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A should be from 102.4 to 153.6.

(13) Substitute 1.6 percent neutral density filter (PN 2998-933-3) for the 8.0 percent neutral density filter on LA-233A.

(14) Set EXP SIGNAL RANGE switch (LENS CONE section) on LS-80A to 0-100 position.

(15) Readjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A for a null indication on the vtvm; the EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A should be from 19.97 to 29.95.

(16) Substitute 0.5 percent neutral density filter (PN 2998-933-4) for the 1.6 percent neutral density filter on LA-233A.

(17) Readjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A for a null indication on the vtvm; the EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A should be from 6.4 to 9.6.

(18) Set the POWER switch (PANEL POWER section) on LS-80A to OFF position. All indicators and LA-233A should go out.

(19) Turn ac and dc power sources off.

(20) Disconnect test setup.

b. Troubleshooting Chart. Steps referenced in the *Trouble symptom* column refer to numbered subparagraphs in the operational check (*a* above). Electronic parts and associated circuitry referenced in the troubleshooting chart are shown in the schematic diagram (fig. 2-23) and wiring diagram (fig. 5-27).

Item No.	Trouble symptom	Probable cause	Checks and corrective measures
1	Null cannot be obtained on vtvm (step 8).	*a.* Defective photo cell 5V1 *b.* Defective pendant connector 5P1.	*a.* Check photo cell and replace if defective. *b.* Check pendant connector and replace if defective.
2	Null can be obtained on vtvm but EXP SIGNAL FOOT-LAMBERTS control on LS-80A does not indicate from 1280 to 1920 (step 8).	Defective photo cell 5V1	Check photo cell and replace if defective.
3	Null cannot be obtained on vtvm (step 10).	*a.* Defective photo cell 5V1 *b.* Defective pendant connector 5P1	*a.* Check photo cell and replace if defective. *b.* Check pendant connector and replace if defective.
4	Null can be obtained on vtvm but EXP SIGNAL FOOT-LAMBERTS control on LS-80A does not indicate from 320 to 480 (step 10).	Defective photo cell 5V1	Check photo cell and replace if defective.
5	Null cannot be obtained on vtvm (step 12).	*a.* Defective photo cell 5V1 *b.* Defective pendant connector 5P1	*a.* Check photo cell and replace if defective. *b.* Check pendant connector and replace if defective.
6	Null can be obtained on vtvm but EXP SIGNAL FOOT-LAMBERTS control on LS-80A does not indicate from 102.4 to 153.6 (step 12).	Defective photo cell 5V1	Check photo cell and replace if defective.
7	Null cannot be obtained on vtvm (step 15).	*a.* Defective photo cell 5V1 *b.* Defective pendant connector 5P1	*a.* Check photo cell and replace if defective. *b.* Check pendant connector and replace if defective.
8	Null can be obtained on vtvm but EXP SIGNAL FOOT-LAMBERTS control on LS-80A does not indicate from 19.97 to 29.95 (step 15).	Defective photo cell 5V1	Check photo cell and replace if defective.
9	Null cannot be obtained on vtvm (step 17).	*a.* Defective photo cell 5V1 *b.* Defective pendant connector 5P1	*a.* Check photo cell and replace if defective. *b.* Check pendant connector and replace if defective.
10	Null can be obtained on vtvm but EXP SIGNAL FOOT-LAMBERTS control on LS-80A does not indicate from 6.4 to 9.6 (step 17).	Defective photo cell 5V1	Check photo cell and replace if defective.

c. Voltage and Resistance (V & R) Measurements. Not applicable.

5-17. Camera Pulse Panel (134AV81400-1 or 134AV81400-3) (Unit 6) Troubleshooting

The troubleshooting procedures to be performed by general support maintenance are identical with the troubleshooting procedures performed by direct support maintenance (para 3-9).

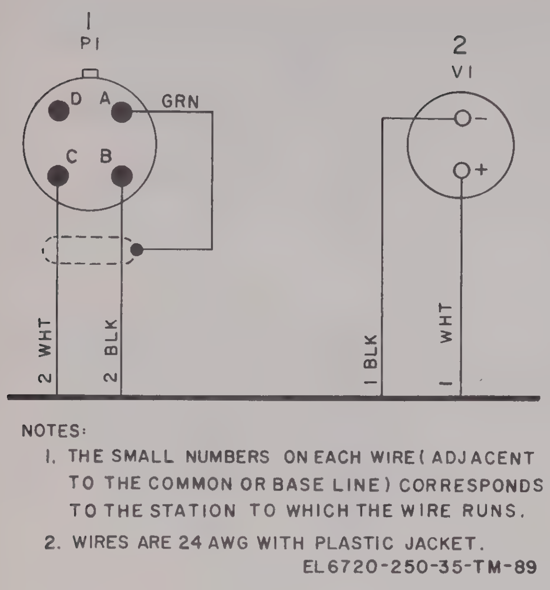


Figure 5-27. Light sensor, wiring diagram.

5-18. Pod Assembly (Unit 10) Troubleshooting

Refer to TM 11-6760-228-35-1 for general support troubleshooting procedures on pod assembly.

5-19. Camera (Unit 9) Troubleshooting

Refer to TM 11-6720-236-35 for general support troubleshooting procedures on camera.

5-20. Camera Mount A (Unit 11) or Camera Mount B (Unit 12) Troubleshooting

The troubleshooting procedures to be performed by general support maintenance consists of insuring that the camera mount A or camera mount B can be rotated from 30° left to 30° right without any binding.

5-21. Flight Line Tracker (Unit 13) Troubleshooting

The troubleshooting procedures to be performed by general support maintenance consist of—

a. Insuring that the flight line tracker is mounted firmly in place on the aircraft glareshield.

b. Insuring that the vertical sight indicator is centered within its associated channel assembly.

5-22. Right Oblique Sight (Unit 14) and Left Oblique Sight (Unit 15) Troubleshooting

The troubleshooting procedures to be performed by general support maintenance on the right and left oblique sights are identical and consist of insuring that the depression angle scale indexes properly at the appropriate depression angle.

Section III. ADJUSTMENTS, ALIGNMENT, REPAIR, REMOVAL, AND REPLACEMENT

WARNING

High voltage is used in this equipment. Be careful when working on the high voltage (+2500 vdc), 115-volt ac, 400-Hz and +28-volt dc connections.

CAUTION

Do not use an ac soldering gun; damaging voltage may be induced in the circuitry.

5-23. General Replacement Techniques

a. The manual V/H control panel (Unit 7), photo system assembly (Unit 1), rotary mount actuator (Unit 2) and pod assembly (Unit 10) are transistorized. If the soldering iron (pencil-type, 25-watt maximum capacity) must be used with ac, use an isolation transformer between the iron and ac power source.

b. Marking.

(1) *Electrical parts.* During disassembly, mark or tag all electrical connections to assure proper connections during reassembly. Before a part is removed, note the position of the part and its leads. Wire the replacement part in essentially the same position to avoid undesired coupling and shorting of wires.

(2) *Mechanical parts.* During disassembly, mark all gears, shafts, and mechanical parts by scribe marks or other appropriate means to assure proper orientation and positioning during reassembly.

c. Liquid staking. To remove screws and nuts that have been assembled with liquid staking, apply heat with a soldering iron to loosen the bond.

d. When soldering transistor or diode leads, solder quickly; wherever wiring permits, use a heat sink (such as long-nosed pliers) between the soldered joint and the transistor or diode.

5-24. Considerations Before Disassembly

Repairs by the general support maintenance repairman that can be made by disassembly of the particular parts that operate as a group to perform a function are outlined in *a* through *n* below. Refer to the paragraphs concerning the defective major component. Repair or replace the defective assembly, part or parts; then reassembly the major component.

a. Manual V/H Control Panel (Unit 7). Repairs are made to the manual V/H control panel after removal from the aircraft. Refer to paragraphs 3-12, and 5-25 through 5-32 for disassembly and reassembly of the manual V/H control panel parts shown in figures 3-17, and 5-28 through 5-35.

b. Photo Junction Panel (Unit 8). Repairs are made to the photo junction panel at direct support maintenance, refer to paragraph 3-13.

c. Photo Control Panel (Unit 3). Repairs are made to the photo control panel after removal from the aircraft. Refer to paragraphs 3-14 and 5-34 for disassembly and reassembly of the photo control panel parts shown in figures 3-19 and 5-36.

d. Photo System Assembly (Unit 1). Repairs are made to the photo system assembly after removal from the aircraft. Refer to paragraphs 3-15, 5-35 through 5-39 for disassembly and reassembly of the photo system assembly parts shown in figures 3-20, and 5-37 through 5-41.

e. Rotary Mount Actuator (Unit 2). Repairs are made to the rotary mount actuator after removal from the aircraft. Refer to paragraphs 5-40 through 5-42 for disassembly and reassembly of the rotary mount actuator parts shown in figures 5-44 and 5-45.

f. Door Actuator (Unit 4). Repairs are made to the door actuator after removal from the aircraft. Refer to paragraphs 5-43 and 5-44 for disassembly and reassembly of the door actuator parts shown in figures 5-46 and 5-47.

g. Light Sensor (Unit 5). Repairs are made to the light sensor after removal from the aircraft. Refer to paragraph 5-45 for disassembly and reassembly of the light sensor parts shown in figure 5-48.

h. Camera Pulse Panel (134AV81400-1 or 134AV81400-3) (Unit 6). Repairs are made to the camera pulse panel at direct support maintenance, refer to paragraph 3-16.

i. Pod Assembly (Unit 10). Refer to TM 11-5760-228-35-1 for repairs on pod assembly.

j. Camera (Unit 9). Refer to TM 11-6720-236-35 for repairs on camera.

k. Camera Mount A (unit 11). Repairs are made to the camera mount A after removal from the aircraft. Refer to paragraphs 5-49 and 5-50 for disassembly and reassembly of the camera mount A parts shown in figures 5-49 and 5-50 (1) and (2).

l. Camera Mount B (Unit 12). Repairs are made to the camera mount B after removal from the aircraft. Refer to paragraphs 5-51 and 5-52 for disassembly and reassembly of the camera mount B parts shown in figures 5-51 and 5-52 (1) and (2).

m. Flight Line Tracker (Unit 13). Repairs are made to the flight line tracker after removal from the aircraft. Refer to paragraph 5-53 for disassembly and reassembly of the flight line tracker parts shown in figure 5-53.

n. Right Oblique Sight (Unit 14) and Left Oblique Sight (Unit 15). Repairs are made to the right oblique sight and left oblique sight after removal from the aircraft. Refer to paragraph 5-54 for disassembly and reassembly of the right oblique sight and left oblique sight parts shown in figure 5-54.

5-25. Manual V/H Control Panel (Unit 7), Disassembly and Reassembly
(fig. 5-28)

a. Disassembly. To disassemble the manual V/H control panel, proceed as follows:

(1) Perform paragraph 3-12*a*.

(2) Unsolder and carefully mark or tag all electrical connections to receptacle 7TP8 through 7TP10 (5).

(3) Remove two nuts (1), two washers (2), two washers (3), and two screws (4) securing receptacle 7TP8 through 7TP10 (5) to chassis (86). Remove receptacle 7TP8 through 7TP10 (5) from chassis (86).

(4) Unsolder and carefully mark or tag all wires that pass through clamp (10). Remove wires from clamp (10).

(5) Remove nut (6), washer (7), washer (8), and screw (9) securing clamp (10) to chassis (86). Remove clamp (10) from chassis (86).

(6) Unsolder and carefully mark or tag all wires that pass through clamp (11). Remove wires from clamp (11).

(7) Remove nut (6), washer (7), washer (8), and screw (9) securing clamp (11) to chassis (86). Remove clamp (11) from chassis (86).

(8) Unsolder and carefully mark or tag all electrical connections to potentiometer 7R1 (16).

(9) Remove two nuts (12), two washers (13), two washers (14), and two screws (15) securing potentiometer 7R1 (16) to chassis (86).

Remove potentiometer 7R1 (16) from chassis (86).

(10) Remove two screws (17) that secure amplifier 7AR1 (18) to connector 7J4 (30). Remove amplifier 7AR1 (18) from connector (30).

(11) Unsolder and remove capacitor 7C13 (19) from terminal board 7TB1 (25) and terminal (28).

(12) Unsolder and remove capacitor 7C10 (20) from connector 7J4 (30).

(13) Unsolder and remove diode 7CR1 (21) from connector 7J4 (30).

(14) Unsolder and carefully mark or tag all electrical connections to terminal board 7TB1 (25).

(15) Remove two screws (22), two washers (23) and two washers (24) securing terminal board 7TB1 (25) to chassis (86). Remove terminal board 7TB1 (25) from chassis (86).

(16) Unsolder and carefully mark or tag all electrical connections to connector 7J4 (30).

(17) Remove two nuts (26), two washers (27), terminal (28), and two screws (29) securing connector 7J4 (30) to chassis (86). Remove connector 7J4 (30) from chassis (86).

(18) Unsolder and carefully mark or tag all electrical connections to resistor 7R4 (35).

(19) Remove nut (31) washer (32), washer (33), and screw (34) securing resistor 7R4 (35) to chassis (86). Remove resistor 7R4 (35) from chassis (86).

(20) Unsolder and carefully mark or tag all wires passing through chassis (86) in area of grommets (36 and 37). Remove wires from area of grommets (36 and 37).

(21) Remove grommets (36 and 37) from chassis (86).

(22) Unsolder and remove capacitor 7C15 (38) from connector 7J2 (48).

(23) Unsolder and remove resistor 7R2 (39) from two terminals (84).

(24) Unsolder and carefully mark or tag all wires that pass through clamp (43). Remove wires from clamp (43).

(25) Remove nut (40), washer (41), and screw (42) securing clamp (43) to chassis (86). Remove clamp (43) from chassis (86).

(26) Unsolder and carefully mark or tag all electrical connections to connector 7J2 (48).

(27) Remove two nuts (44), two washers (45), two washers (46), and two screws (47) securing connector 7J2 (48) to chassis (86). Remove connector 7J2 (48) from chassis (86).

(28) Unsolder and carefully mark or tag all electrical connections to filter 7FL1 (49).

(29) Remove nut (49) securing filter 7FL1 (49) to chassis (86). Remove filter 7FL1 (49) from chassis (86).

(30) Unsolder and carefully mark or tag all electrical connections to filter 7FL2 (50).

(31) Remove nut (50) securing filter 7FL2 (50) to chassis (86). Remove filter FL2 (50) from chassis (86).

(32) Unsolder and remove capacitor 7C11 (51) from terminal E16 (54) and terminal E11 (84).

(33) Remove nut (52), washer (53), terminal (54), washer (55), and screw (56) from chassis (86).

(34) Unsolder and carefully mark or tag all electrical connections to zener diode 7VR1 (61) and terminal (61).

(35) Remove nut (57), washer (58), terminal (61), washer (59), washer (60), and washer (60) securing Zener diode 7VR1 (61) to chassis (86). Remove Zener diode 7VR1 (61) from chassis (86).

(36) Remove grommet (62) from chassis (86).

(37) Unsolder and remove capacitor 7C7 (63), capacitor 7C9 (63), and capacitor 7C8 (64).

(38) Unsolder and carefully mark or tag all electrical connections to transformer 7T1 (69).

(39) Remove two screws (65), two washers (66), two seal washers (67), and strap (68) securing transformer 7T1 (69) to chassis (86). Remove transformer 7T1 (69) from chassis (86).

(40) Unsolder and remove capacitor 7C1 (70) and capacitor 7C2 (70) from transformer 7T1 (69).

(41) Unsolder and carefully mark or tag all electrical connections to transformer 7T2 (75).

(42) Remove two screws (71), two washers (72), two seal washers (73), and strap (74) securing transformer 7T2 (75) to chassis (86). Remove transformer 7T2 (75) from chassis (86).

(43) Unsolder and remove capacitor 7C3 (76) and capacitor 7C4 (76) from transformer 7T2 (75).

(44) Unsolder and carefully mark or tag all electrical connections to transformer 7T3 (77).

(45) Remove two screws (71), two washers (72), two seal washers (73), and strap (74) securing transformer 7T3 (77) to chassis (86). Remove transformer 7T3 (77) from chassis (86).

(46) Unsolder and remove capacitor 7C5 (76) and capacitor 7C6 (76) from transformer 7T3 (77).

(47) Unsolder and carefully mark or tag all electrical connections to connector 7J1 (80).

(48) Remove four nuts (78) and four screws (79) securing connector (80) and gasket (81) to chassis (86). Remove connector 7J1 (80) and gasket (81) from chassis (86).

(49) Unsolder and carefully mark or tag all electrical connections to connector 7P1 (82). Remove connector 7P1 (82) from pendant cable.

(50) Unsolder and carefully mark or tag all electrical connections to terminals 7E1 through 7E13 (84).

(51) Remove 13 screws (83) securing terminals 7E1 through 7E13 (84) to chassis (86). Remove terminals 7E1 through 7E13 (84) from chassis (86).

(52) Remove nameplate (85) from chassis (86).

(53) For disassembly of chassis (86), refer to paragraph 5-26*a*.

b. Reassembly. To reassemble the manual V/H control panel, proceed as follows:

NOTE

Refer to the wiring diagram (fig. 3-3) to obtain correct electrical connections and parts location.

(1) Perform paragraph 5-26*b* to insure that chassis (86) is completely assembled.

(2) Install nameplate (85) to chassis (86).

(3) Install 13 terminals 7E1 through 7E13 (84) to chassis (86), using 13 screws (83).

(4) Solder electrical connections to terminals 7E1 through 7E13 (84).

(5) Solder appropriate electrical connections to connector 7P1 (82).

(6) Install connector 7J1 (80) and gasket (81) to chassis (86), using four screws (79) and four nuts (78).

(7) Solder appropriate electrical connections to connector 7J1 (80).

(8) Solder capacitor 7C5 (76) and capacitor 7C6 (76) to transformer 7T3 (77).

(9) Install transformer 7T3 (77) to chassis (86), using two screws (71), two washers (72), two seal washers (73), and strap (74).

(10) Solder appropriate electrical connections to transformer 7T3 (76).

(11) Solder capacitor 7C3 (76) and capacitor 7C4 (76) to transformer 7T2 (75).

(12) Install transformer 7T2 (75) to chassis (86), using two screws (71), two washers (72), two seal washers (73), and strap (74).

(13) Solder appropriate electrical connections to transformer 7T2 (75).

(14) Solder capacitor 7C1 (70) and capacitor 7C2 (70) to transformer 7T1 (69).

(15) Install transformer 7T1 (69) to chassis (86), using two screws (65), two washers (66), two seal washers (67), and strap (68).

(16) Solder appropriate electrical connections to transformer 7T1 (69).

(17) Install capacitor 7C8 (64), capacitor 7C9 (63), and capacitor 7C7 (63) to chassis (86).

(18) Solder appropriate electrical connections to capacitor 7C8 (64), capacitor 7C9 (63), and capacitor 7C7 (63).

(19) Install grommet (62) to chassis (86).

(20) Install zener diode 7VR1 (61) to chassis (86), using two washers (60), washer (59), terminal (61), washer (58), and nut (57).

(21) Solder appropriate electrical connections to Zener diode 7VR1 (61) and terminal (61).

(22) Install screw (56), washer (55), terminal (54), washer (53), and nut (52) to chassis (86).

(23) Solder capacitor 7C11 (51) to terminal E11 (84) and terminal E16 (54).

(24) Install filter 7FL2 (50) to chassis (86), using nut (50).

(25) Solder appropriate electrical connections to filter 7FL2 (50).

(26) Install filter 7FL1 (49) to chassis (86), using nut (49).

(27) Solder appropriate electrical connections to filter 7FL1 (49).

(28) Install connector 7J2 (48) to chassis (86), using two screws (47), two washers (46), two washers (45), and two nuts (44).

(29) Solder appropriate electrical connections to connector 7J2 (48).

(30) Route appropriate wires through clamp (43).

(31) Install clamp (43) to chassis (86), using screw (42), washer (41), and nut (40).

(32) Solder resistor 7R2 (39) to appropriate terminals (84).

(33) Solder capacitor 7C15 (38) to connector 7J2 (48).

(34) Install grommets (36 and 37) to chassis (86).

(35) Route appropriate wires through chassis (86) in area of grommets (36 and 37).

(36) Install resistor 7R4 (35) to chassis (86), using screw (34), washer (33), washer (32), and nut (31).

(37) Solder appropriate electrical connections to resistor 7R4 (35).

(38) Install connector 7J4 (30) to chassis (86), using two screws (29) one terminal (28), two washers (27), and two nuts (26).

(39) Solder diode 7CR1 (21) to connector 7J4 (30).

(40) Solder capacitor 7C10 (20) to connector 7J4 (30).

(41) Solder appropriate electrical connections to connector 7J4 (30).

(42) Install amplifier 7AR1 (18) to connector 7J4 (30), using two screws (17).

(43) Install terminal board 7TB1 (25) to chassis (86), using two screws (22), two washers (23), and two washers (24).

(44) Solder capacitor 7C13 (19) to terminal board 7TB1 (25) and terminal (28).

(45) Solder appropriate electrical connections to terminal board 7TB1 (25).

(46) Install potentiometer 7R1 (16) to chassis (86), using two screws (15), two washers (14), two washers (13), and two nuts (12).

(47) Solder appropriate electrical connections to potentiometer 7R1 (16).

(48) Route appropriate wires through clamp (11).

(49) Install clamp (11) to chassis (86), using screw (9), washer (8), washer (7), and nut (6).

(50) Route appropriate wires through clamp (10).

(51) Install clamp (10) to chassis (86), using screw (9), washer (8), washer (7), and nut (6).

(52) Install receptacle 7TP8 through 7TP10 (5) to chassis (86), using two screws (4), two washers (3), two washers (2), and two nuts (1).

(53) Solder appropriate electrical connections to receptacle 7TP8 through 7TP10 (5).

(54) Refer to paragraph 3-12*b* for procedures completing reassembly of manual V/H control panel.

5-26. Manual V/H Control Panel (Unit 7) Chassis, Disassembly and Reassembly (fig. 5-29)

a. Disassembly. To disassemble the manual V/H control panel chassis, proceed as follows:

(1) Perform disassembly procedures given in paragraphs 3-12*a* and 5-25*a*.

(2) Remove four rivets (1) securing upper flange (4) to chassis (38). Remove upper flange (4) from chassis (38).

(3) Remove two rivets (2) securing nutplate (3) to upper flange (4). Remove nutplate (3) from upper flange (4).

(4) Remove four rivets (1) securing lower flange (5) to chassis (38). Remove lower flange (5) from chassis (38).

(5) Remove eight screws (6) securing bulkhead (16) and bracket (22) to chassis (38). Remove bulkhead (16) and bracket (22) from chassis (38).

(6) Remove four rivets (7) securing bulkhead (16) to bracket (22). Remove bulkhead (16) from bracket (22).

CAUTION

Pressure pad (8) is bonded to bulkhead (16) using an adhesive. Use extreme care when loosening and removing to prevent damage to pressure pad.

(7) Carefully loosen and remove pressure pad (8) from bulkhead (16).

(8) Remove two rivets (9) securing retainer (10) to bulkhead (16). Remove retainer (10) from bulkhead (16).

(9) Remove two nuts (11) from bulkhead (16).

(10) Remove four rivets (12) securing the two nut plates (13) to bulkhead (16). Remove two nut plates (13) from bulkhead (16).

(11) Remove eight rivets (14) securing four nut plates (15) to bulkhead (16). Remove four nut plates (15) from bulkhead (16).

(12) Remove two rivets (17) securing clip (18) to bracket (22). Remove clip (18) from bracket (22).

(13) Remove two rivets (9) securing retainer (19) to bracket (21). Remove retainer (19) from bracket (21).

(14) Remove three rivets (20) securing bracket (21) to bracket (22). Remove bracket (21) from bracket (22).

(15) Remove eight rivets (14) securing four nut plates (15) to bracket (22). Remove nut plates (15) from bracket (22).

(16) Remove 32 rivets (23) securing 16 nut plates (24) to chassis (38). Remove 16 nut plates (24) from chassis (38).

(17) Remove six rivets (25) securing three spacers (26) and three nut plates (27) to chassis (38). Remove three spacers (26) and three nut plates (27) from chassis (38).

(18) Remove six rivets (28) securing three retainers (29) to chassis (38). Remove retainers (29) from chassis (38).

(19) Remove two rivets (30) securing brack-
t (31) to chassis (38). Remove bracket (31) rom chassis (38).

(20) Remove four rivets (32) securing two rackets (33) to chassis (38). Remove two brack-
ts (33) from chassis (38).

(21) Remove two rivets (34) securing brack-
t (35) to chassis (38). Remove bracket (35) rom chassis (38).

(22) Remove six rivets (36) securing three lips (37) to chassis (38). Remove three clips 37) from chassis (38).

(23) Remove eight rivets (2) securing four ut plates (3) to chassis (38). Remove four nut lates (3) from chassis (38).

b. Reassembly. To reassemble the manual V/H ontrol panel chassis, proceed as follows:

(1) Install four nutplates (3) to chassis 38), using eight rivets (2).

(2) Install three clips (37) to chassis (38), ising six rivets (36).

(3) Install bracket (35) to chassis (38), ising two rivets (34).

(4) Install two brackets (33) to chassis 38), using four rivets (32).

(5) Install bracket (31) to chassis (38), ising two rivets (30).

(6) Install three retainers (29) to chassis 38), using six rivets (28).

(7) Install three nutplates (27) and three pacers (26) to chassis (38), using six rivets 25).

(8) Install 16 nutplates (24) to chassis 38), using 32 rivets (23).

(9) Install four nut plates (15) to bracket 22), using eight rivets (14).

(10) Install bracket (21) to bracket (22), sing three rivets (20).

(11) Install retainer (19) to bracket (21), sing two rivets (9).

(12) Install clip (18) to bracket (22), using wo rivets (17).

(13) Install four nutplates (15) to bulkhead 16), using eight rivets (14).

(14) Install two nutplates (13) to bulkhead 16), using four rivets (12).

(15) Install two nuts (11) in bulkhead (16).

(16) Install retainer (10) to bulkhead (16), sing two rivets (9).

NOTE

Be sure that surface on bulkhead (16) requiring application of adhesive, is properly cleaned.

(17) Using adhesive (Military Specification MIL-C-4003), install pressure pad (8) to bulkhead (16).

(18) Install bulkhead (16) to bracket (22), using four rivets (7).

(19) Install bulkhead (16) and bracket (22) to chassis (38), using eight screws (6).

(20) Install lower flange (5) to chassis (38), using four rivets (1).

(21) Install nutplate (3) to upper flange (4), using two rivets (2).

(22) Install upper flange (4) to chassis (38), using four rivets (1).

(23) Refer to paragraphs 5-25*b* and 3-12*b* for procedures continuing the reassembly of the manual V/H control panel.

5-27. Manual V/H Control Panel (Unit 7) Covers, Disassembly and Reassembly (fig. 5-30)

NOTE

The manual V/H control panel top and bottom covers (2 and 3, fig. 3-17), respectively, are removed in paragraph 3-12*a*.

a. Disassembly. To disassemble the manual V/H control panel top and bottom covers, proceed as follows:

CAUTION

Strips and pressure pads are bonded to the top and bottom covers using an adhesive. Use extreme care when loosening and removing to prevent possible damage to strips and pressure pads.

(1) Carefully loosen and remove the two side strips (1) from top cover (7) as shown in A, figure 5-30.

(2) Carefully loosen and remove end strip (2) from top cover (7).

(3) Carefully loosen and remove end strip (3) from top cover (7).

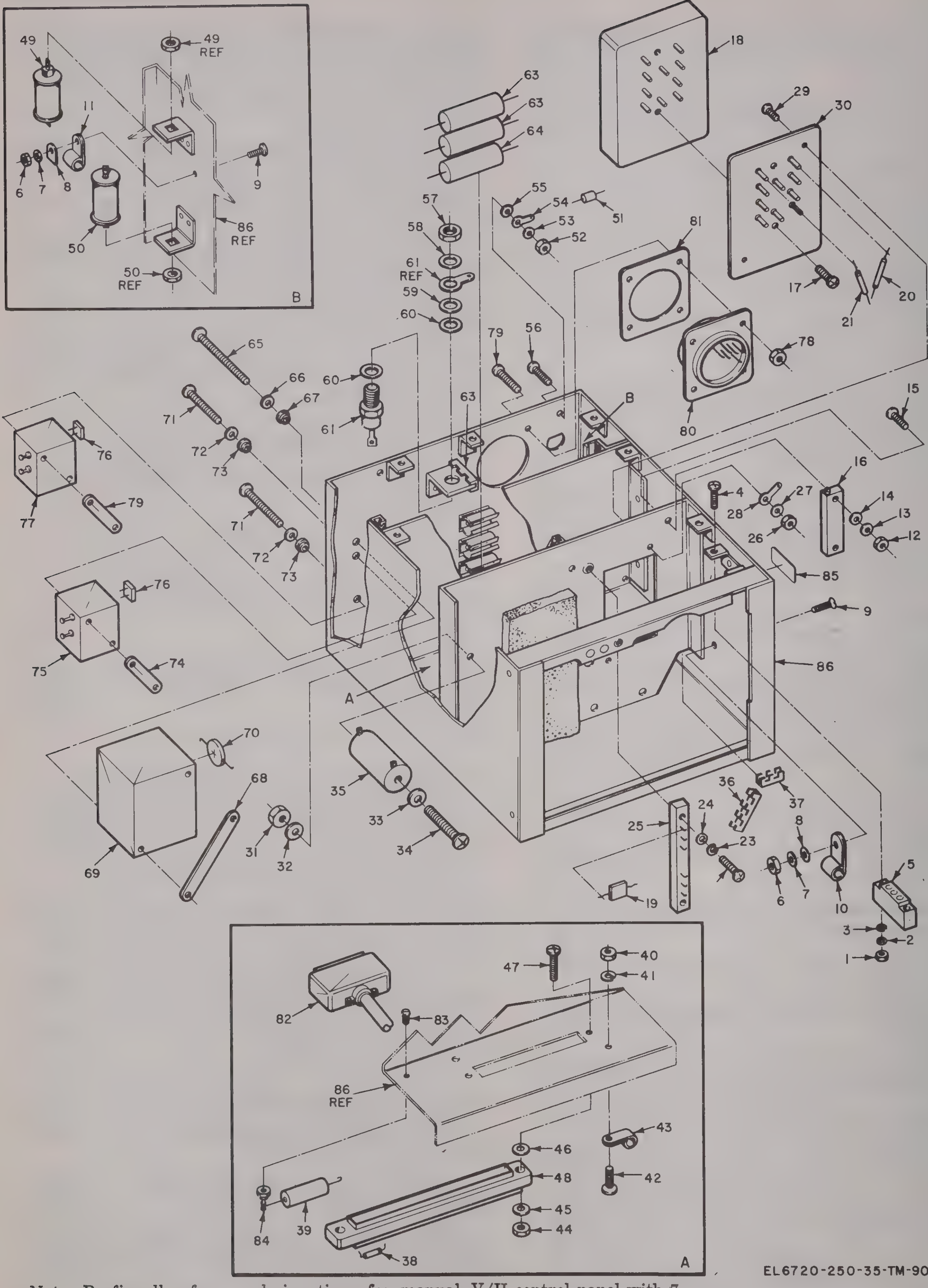
(4) Carefully loosen and remove center strip (4) from top cover (7).

(5) Carefully loosen and remove pressure pad (5) from top cover (7).

(6) Carefully loosen and remove pressure pad (6) from top cover (7).

(7) Carefully loosen and remove the two side strips (8) from bottom cover (14) as shown in B, figure 5-30.

(8) Carefully loosen and remove end strip (9) from bottom cover (14).



Note. Prefix all reference designations for manual V/H control panel with 7.

1 Nut (2)
2 Washer (2)
3 Washer (2)
4 Screw (2)

Figure 5–28. Manual V/H control panel, exploded view.

5 Receptacle (TB8 through TP10) (1)
6 Nut (2)
7 Washer (2)
8 Washer (2)
9 Screw (2)
0 Clamp (1)
1 Clamp (1)
2 Nut (2)
3 Washer (2)
4 Washer (2)
5 Screw (2)
6 Potentiometer (R1) (1)
7 Screw (2)
8 Amplifier (AR1) (1)
Capacitor (C13) (1)
Capacitor (C10) (1)
Diode (CR1) (1)
Screw (2)
Washer (2)
Washer (2)
Terminal board (TB1) (1)
Nut (2)
Washer (2)
Terminal (1)
Screw (2)
Connector (J4) (1)
Nut (1)
Washer (1)
Washer (1)
Screw (1)
Resistor (R4) (1)
Grommet (1)
Grommet (1)
Capacitor (C15) (1)
Resistor (R2) (1)
Nut (1)
Washer (1)
Screw (1)
Clamp (1)
Nut (2)
Washer (2)
Washer (2)
47 Screw (2)
48 Connector (J2) (1)
49 Filter (FL1) (1) (nut supplied with filter)
50 Filter (FL2) (1) (nut supplied with filter)
51 Capacitor (C11) (1)
52 Nut (1)
53 Washer (1)
54 Terminal (E16) (1)
55 Washer (1)
56 Screw (1)
57 Nut (1)
58 Washer (1)
59 Washer (1)
60 Washer (2)
61 Zener diode (VR1) (1) (terminal supplied with diode)
62 Grommet (1)
63 Capacitor (C7 and C9) (2)
64 Capacitor (C8) (1)
65 Screw (2)
66 Washer (2)
67 Washer, seal (2)
68 Strap (1)
69 Transformer (T1) (1)
70 Capacitor (C1 and C2) (2)
71 Screw (4)
72 Washer (4)
73 Washer, seal (4)
74 Strap (2)
75 Transformer (T2) (1)
76 Capacitor (C3 through C6) (4)
77 Transformer (T3) (1)
78 Nut (4)
79 Screw (4)
80 Connector (J1) (1)
81 Gasket (1)
82 Connector (P1) (1)
83 Screw (13)
84 Terminal (E1 through E13) (13)
85 Nameplate (1)
86 Chassis (1)

Figure 5–28—Continued.

(9) Carefully loosen and remove end strip 0) from bottom cover (14).

(10) Carefully loosen and remove center rip (11) from bottom cover (14).

(11) Carefully loosen and remove pressure d (12) from bottom cover (14).

(12) Carefully loosen and remove pressure d (13) from bottom cover (14).

b. Reassembly. To reassemble the manual V/H ntrol panel top and bottom covers, proceed as llows:

NOTE

Be sure that all surfaces that require application of adhesive are properly cleaned.

(1) Using adhesive (Military Specification MIL–C–4003), bond pressure pad (6) to inside of top cover (7) as shown in A, figure 5–30.

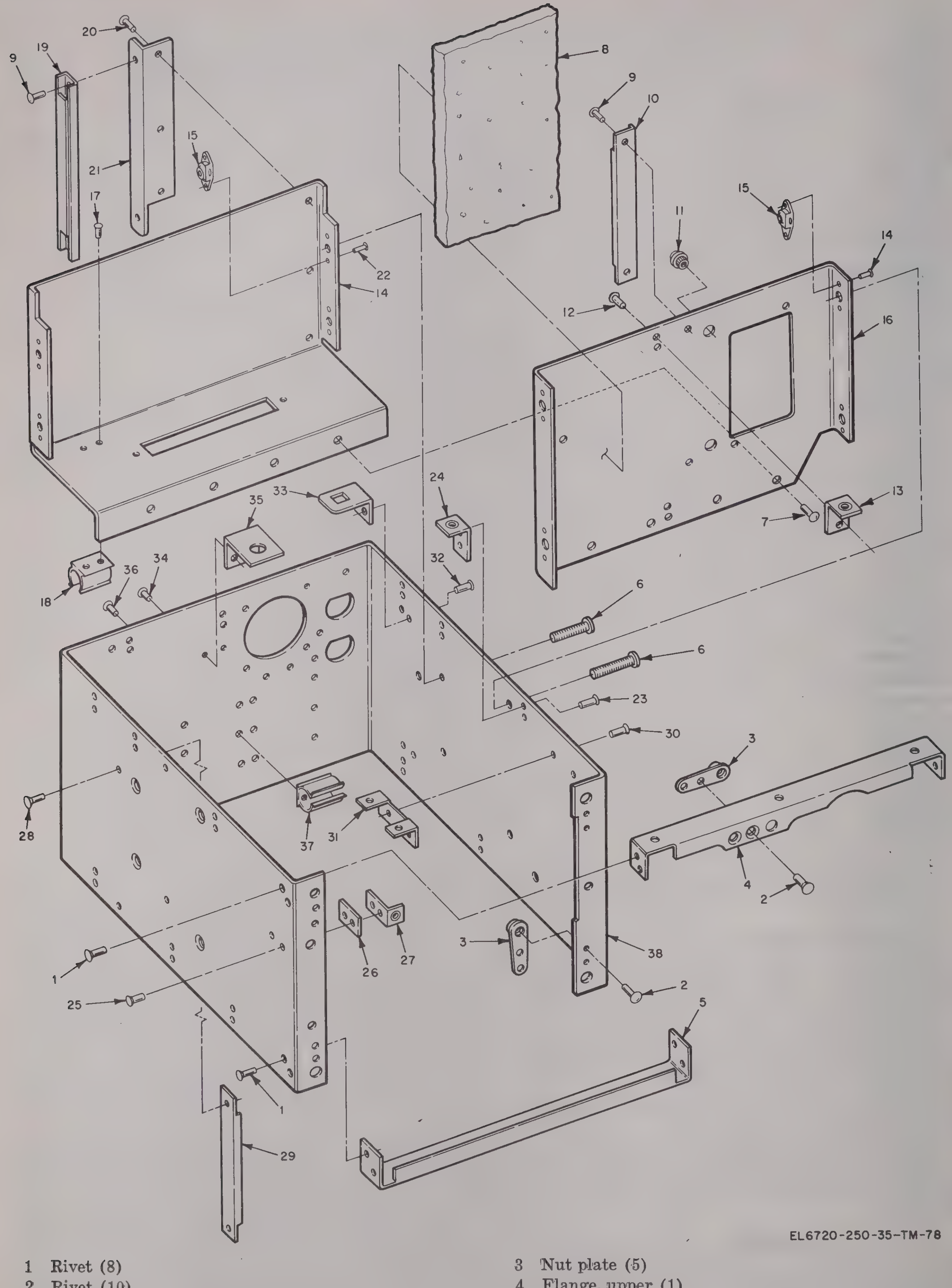
(2) Using adhesive (Military Specification MIL–C–4003), bond pressure pad (5) to inside of top cover (7).

(3) Using eccobond solder 59C adhesive, bond end strip (3) to inside front edge of top cover (7).

(4) Using eccobond solder 59C adhesive, bond end strip (2) to inside edge of top cover (7).

(5) Using eccobond solder 59C adhesive, bond the two side strips (1) to inside of top cover (7).

(6) Using eccobond solder 59C adhesive, bond center strip (4) to inside of top cover (7).



1 Rivet (8)
2 Rivet (10)
3 Nut plate (5)
4 Flange, upper (1)

Figure 5-29. Manual V/H control panel chassis, exploded view.

5 Flange, lower (1)
6 Screw (8)
7 Rivet (4)
8 Pad, pressure (1)
9 Rivet (4)
0 Retainer (1)
1 Nut (2)
2 Rivet (4)
3 Nut plate (2)
4 Rivet (16)
5 Nut plate (8)
6 Bulkhead (1)
7 Rivet (2)
8 Clip (1)
9 Retainer (1)
0 Rivet (3)
1 Bracket (1)
22 Bracket (1)
23 Rivet (32)
24 Nut plate (16)
25 Rivet (6)
26 Spacer (3)
27 Nut plate (3)
28 Rivet (6)
29 Retainer (3)
30 Rivet (2)
31 Bracket (1)
32 Rivet (4)
33 Bracket (2)
34 Rivet (2)
35 Bracket (1)
36 Rivet (6)
37 Clip (3)
38 Chassis (1)

Figure 5-29—Continued.

(7) Using eccobond solder 59C adhesive, ill in any empty spaces between the two side trips (1) and end strips (2) and (3), and cen- er strip (4).

(8) Using adhesive (Military Specification IIL-C-4003), bond pressure pad (13) to inside f bottom cover (14) as shown in B, figure 5-30.

(9) Using adhesive (Military Specification IIL-C-4003), bond pressure pad (12) to inside f bottom cover (14).

(10) Using eccobond solder 59C adhesive, ond end strip (10) to inside front edge of bot- om cover (14).

(11) Using eccobond solder 59C adhesive, ond end strip (9) to inside rear edge of bot- om cover (14).

(12) Using eccobond solder 59C adhesive, ond the two side strips (8) to inside of bottom over (14).

(13) Using eccobond solder 59C adhesive, ond center strip (11) to inside of bottom cover 14).

(14) Using eccobond solder 59C adhesive, ll in any empty spaces between the two side rips (8) and end strips (9) and (10), and cen- r strip (11).

(15) Refer to paragraph 3-12*b* for reassem- y of top and bottom covers (2 and 3, fig. 3- 7) to manual V/H control panel.

-28. Manual V/H Control Panel (Unit 7) Module 7A1, Disassembly and Reassembly
(fig. 5-31).

NOTE

The manual V/H control panel module 7A1 (5, fig. 3-17) is removed in paragraph 3-12*a*.

a. Disassembly. Disassembly of parts from module 7A1 board is obvious from the parts location diagram (fig. 5-31) and upon inspection of the module.

b. Reassembly. Reassembly of parts to module 7A1 board is obvious from the parts location diagram (fig. 5-31) and upon inspection of the module.

NOTE

Refer to the wiring diagram (fig. 5-4) to obtain correct electrical connections and parts location, and paragraph 3-12*b* for reassembly of module 7A1 (5, fig. 3-17) to manual V/H control panel.

5-29. Manual V/H Control Panel (Unit 7) Module 7A5, Disassembly and Reassembly
(fig. 5-32)

NOTE

The manual V/H control panel module 7A5 (6, fig. 3-17) is removed in para 3-12*a*.

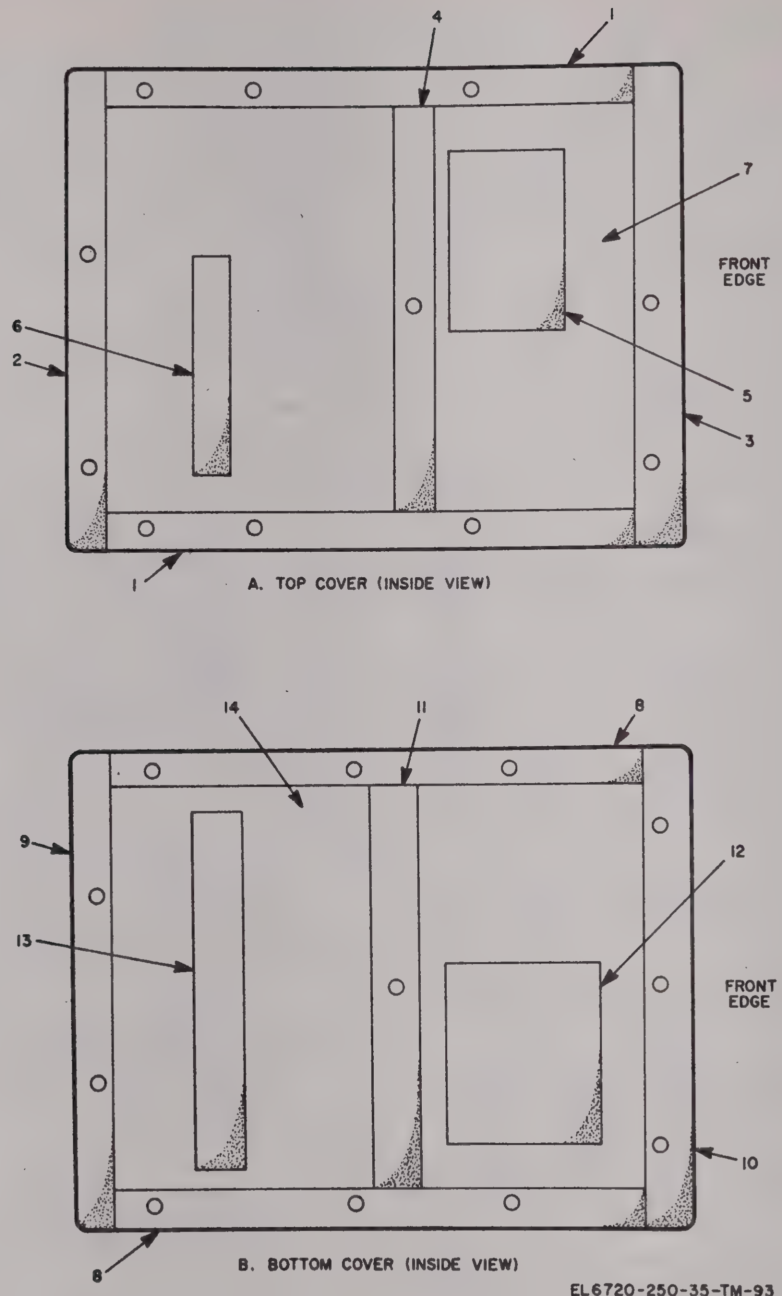
a. Disassembly. To disassemble the manual V/H control panel module 7A5, proceed as follows:

(1) Unsolder and carefully mark or tag all electrical connections that interconnect module 7A5 board (7) and module 7A5A2 (6), module 7A5A3 (5), and module 7A5A4 (4).

(2) Remove four screws (1), four washers (2), and four washers (3), securing module 7A-5A4 (4) to module 7A5 board (7). Remove module 7A5A4 (4) from module 7A5 board (7).

NOTE

Refer to paragraph 5-32*a* for module 7A5A4 (4) disassembly procedures.



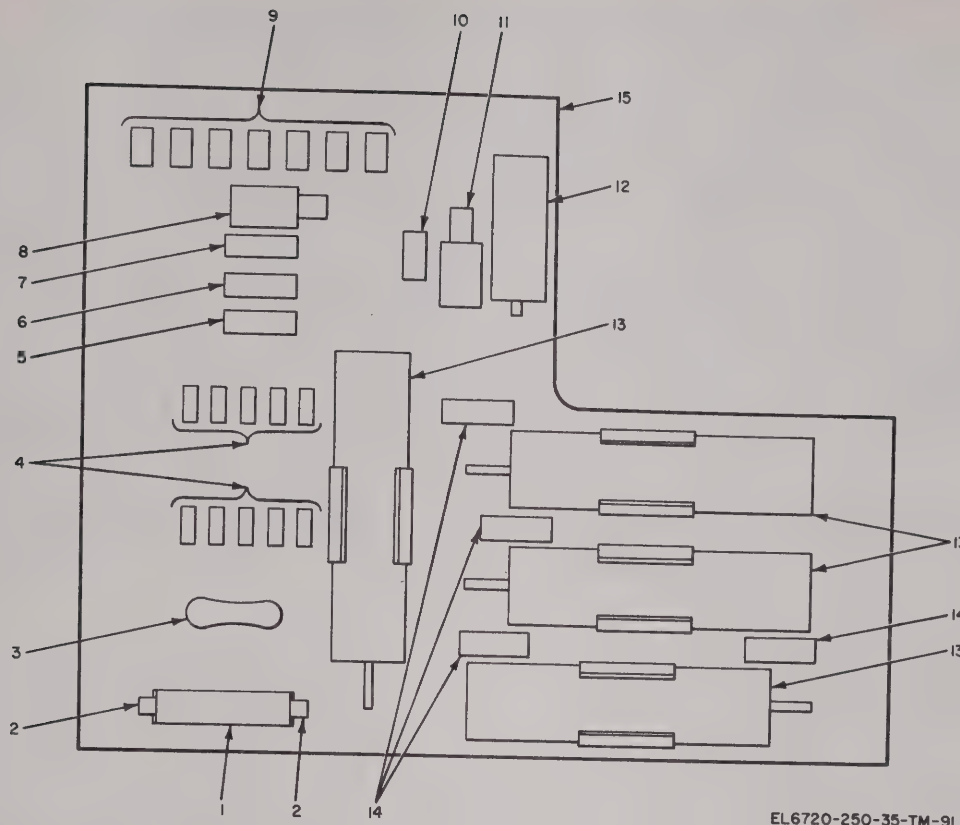
1 Side strip (2)
2 End strip (1)
3 End strip (1)
4 Center strip (1)
5 Pressure pad (1)
6 Pressure pad (1)
7 Top cover (1)
8 Side strip (2)
9 End strip (1)
10 End strip (1)
11 Center strip (1)
12 Pressure pad (1)
13 Pressure pad (1)
14 Bottom cover (1)

Figure 5-30. Manual V/H control panel top cover, bottom cover, parts location diagram.

(3) Remove three screws (1), three washers (2), and three washers (3) securing module 7A-5A3 (5) to module 7A5 board (7). Remove module 7A5A3 (5) from module 7A5 board (7).

NOTE

Refer to paragraph 5-31*a* for module 7A5A3 (5) disassembly procedures.



Note. Prefix all reference designations for manual V/H control panel module A1 with 7A1.

1 Connector (J1) (1)
2 Retainer (2)
3 Resistor (R5) (1)
4 Diode (CR1 through CR10) (10)
5 Resistor (R6) (1)
6 Resistor (R7) (1)
7 Resistor (R8) (1)
8 Zener diode (VR1) (1)
9 Jack (TP1 through TP7) (7)
10 Zener diode (VR2) (1)
11 Zener diode (VR3) (1)
12 Capacitor (C5) (1)
13 Capacitor (C1 through C4) (4) (Potted)
14 Resistor (R1 through R4) (4) (Potted)
15 Board (1)

Figure 5-31. Manual V/H control panel module 7A1, parts location diagram.

(4) Remove four screws (1), four washers (2), and four washers (3) securing module 7A-5A2 (6) to module 7A5 board (7). Remove module 7A5A2 (6) from module 7A5 board (7).

NOTE

Refer to paragraph 5-30*a* for module 7A5A2 (6) disassembly procedures.

b. Reassembly. To reassemble the manual V/H control panel module 7A5, proceed as follows:

NOTE

Refer to paragraph 5-30*b* to insure that module 7A5A2 (6) is completely assembled.

(1) Install module 7A5A2 (6) to module 7A5 board (7), using four washers (3), four washers (2) and four screws (1).

NOTE

Refer to paragraph 5-31*b* to insure that module 7A5A3 (5) is completely assembled.

(2) Install module 7A5A3 (5) to module 7A5 board (7), using three washers (3), three washers (2) and three screws (1).

NOTE

Refer to paragraph 5-32*b* to insure that module 7A5A4 (4) is completely assembled.

(3) Install module 7A5A4 (4) to module 7A5 board (7), using four washers (3), four washers (2), and four screws (1).

NOTE

Refer to wiring diagram (fig. 5-6) to obtain correct electrical connections and parts location.

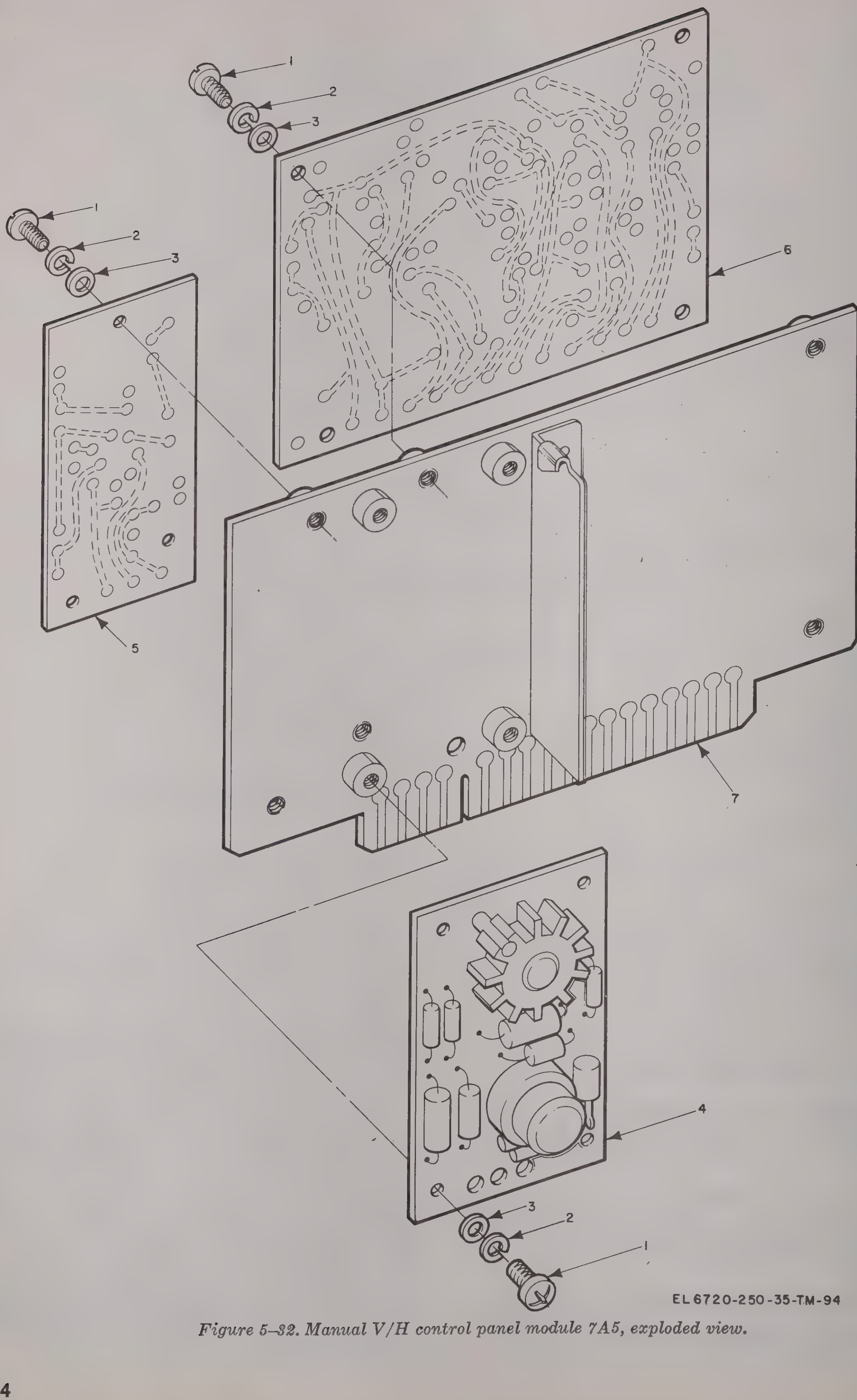


Figure 5-32. Manual V/H control panel module 7A5, exploded view.

Note. Prefix all reference designations for manual V/H control panel module A5 with 7A5.

Screw (11)
Washer (11)
Washer (11)
Module (A4) (1)
5 Module (A3) (1)
6 Module (A2) (1)
7 Module board (1)

Figure 5-32—Continued.

(4) Carefully solder all electrical connec-
ons between module 7A5 board (7) and mod-
e 7A5A2 (6), module 7A5A3 (5), and module
\5A4 (4).

(5) Refer to paragraph 3-12*b* for reassem-
y of module 7A5 (6, fig. 3-17) to manual
/H control panel.

-30. Manual V/H Control Panel (Unit 7) Module 7A5A2, Disassembly and Reassembly (fig. 5-33)

NOTE

The manual V/H control panel module 7A5A2 (6, fig. 5-32) is removed in paragraph 5-29*a*.

a. Disassembly. Disassembly of parts from
odule 7A5A2 is obvious from the parts loca-
on diagram (fig. 5-33) and upon inspection of
e assembly.

b. Reassembly. Reassembly of parts to module
A5A2 is obvious from the parts location dia-
am (fig. 5-33) and upon inspection of the as-
mbly.

NOTE

Refer to the wiring diagram (fig. 5-7) to obtain correct electrical connections and parts location, and paragraph 5-29*b* for reassembly of module 7A5A2 (6, fig. 5-32) to module 7A5.

31. Manual V/H Control Panel (Unit 7) Module 7A5A3, Disassembly and Reassembly (fig. 5-34)

NOTE

The manual V/H control panel module 7A5A3 (5, fig. 5-32) is removed in paragraph 5-29*a*.

ı. Disassembly. Disassembly of parts from
dule 7A5A3 is obvious from the parts location
gram (fig. 5-34) and upon inspection of the
embly.

b. Reassembly. Reassembly of parts to module
5A3 is obvious from the parts location diagram
g. 5-34) and upon inspection of the assembly.

NOTE

Refer to the wiring diagram (fig. 5-8) to obtain correct electrical connections and parts location, and paragraph 5-29*b* for reassembly of module 7A5A3 (5, fig. 5-32) to module 7A5.

5-32. Manual V/H Control Panel (Unit 7) Module 7A5A4, Disassembly and Reassembly (fig. 5-35)

NOTE

The manual V/H control panel module 7A5A4 (4, fig. 5-32) is removed in paragraph 5-29*a*.

a. Disassembly. Disassembly of parts from module 7A5A4 is obvious from the parts location diagram (fig. 5-35) and upon inspection of the assembly.

b. Reassembly. Reassembly of parts to module 7A5A4 is obvious from the parts location diagram (fig. 5-35) and upon inspection of the assembly.

NOTE

Refer to the wiring diagram (fig. 5-9) to obtain correct electrical connections and parts location, and paragraph 5-29*b* for reassembly of module 7A5A4 (4, fig. 5-32) to module 7A5.

5-33. Photo Junction Panel (Unit 8), Disassembly and Reassembly

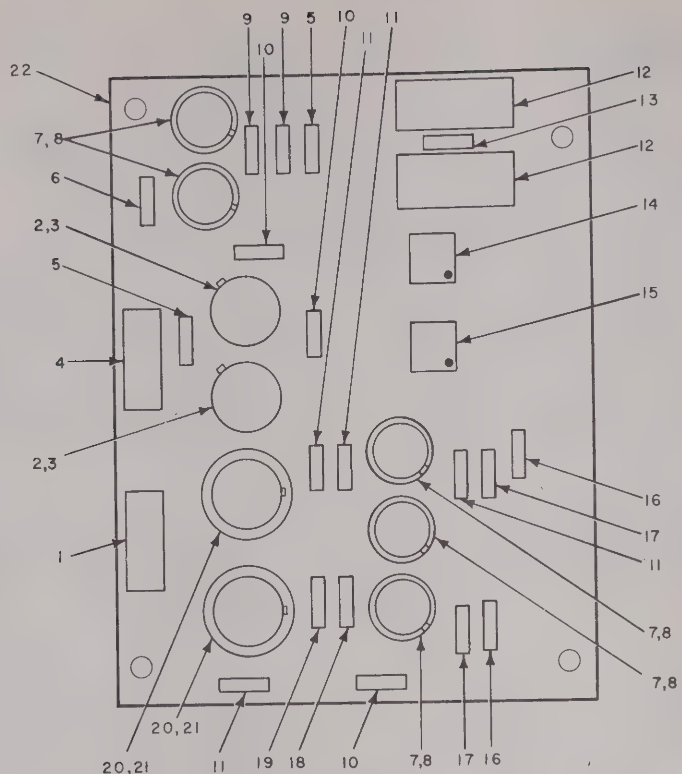
The disassembly and reassembly procedures to be performed by general support maintenance are identical with the disassembly and reassembly procedures performed by direct support maintenance (para 3-13).

5-34. Photo Control Panel (Unit 3), Disassembly and Reassembly (fig. 5-36)

a. Disassembly. To disassemble the photo control panel, proceed as follows:

(1) Perform paragraph 3-14a.

(2) Press out two captive fasteners (2) and remove two grommets (3), only if repair is necessary.



Note. Prefix all reference designations for manual V/H control panel module A5A2 with 7A5A2.

1 Resistor (R7) (1)
2 Transistor (Q1 and Q2) (2)
3 Pad (2)
4 Resistor (R6) (1)
5 Resistor (R1 and R8) (2)
6 Resistor (R2) (1)
7 Transistor (Q3 through Q7) (5)
8 Pad (5)
9 Resistor (R3 and R4) (2)
10 Diode (CR1, CR2, and CR7) (3)
11 Diode (CR3 through CR6) (4)
12 Capacitor (C1 and C2) (2)
13 Resistor (R5) (1)
14 Quad gate (Z1) (1)
15 Flip-flop (Z2) (1)
16 Resistor (R12 and R14) (2)
17 Resistor (R11 and R13) (2)
18 Resistor (R10) (1)
19 Resistor (R9) (1)
20 Relay (K1 and K2) (2)
21 Pad (2)
22 Board (1)

Figure 5-33. Manual V/H control panel module 7A5A2, parts location diagram.

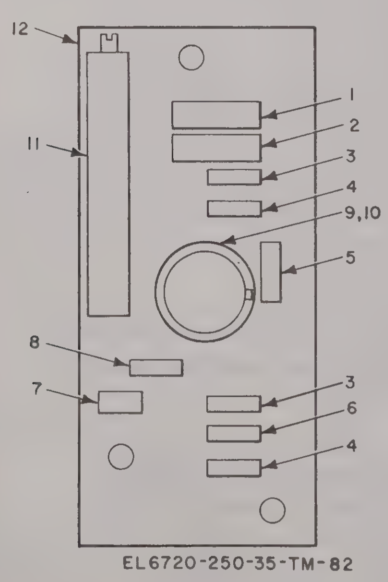


Figure 5-34. Manual V/H control panel module 7A5A3, ts location diagram.

Note. Prefix all reference designations for manual V/H control panel module A5A3 with 7A5A3.

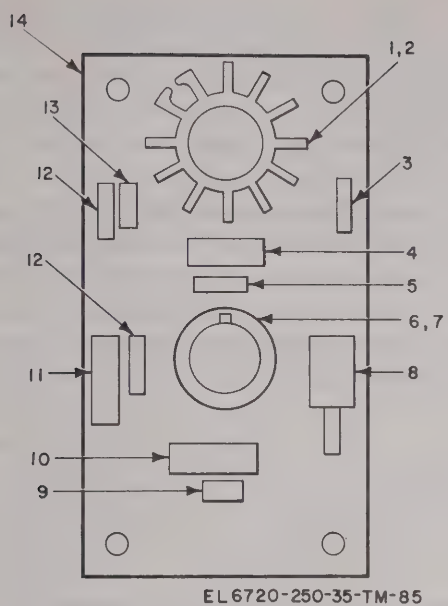
1 Resistor (R3) (1)
2 Resistor (R1) (1)
3 Resistor (R4 and R6) (3)
4 Diode (CR1 and CR2) (2)
5 Capacitor (C1) (1)
6 Resistor (R5) (1)
7 Capacitor (C2) (1)
8 Zener diode (VR1) (1)
9 Amplifier (AR1) (1)
10 Pad (1)
11 Potentiometer (R2) (1)
12 Board (1)

Figure 5-34—Continued.

(3) Remove plates (4 and 5) from cover (1

(4) Remove four spacers (6) by removi eight screws (7). If necessary, remove tubing (from each spacer (6).

(5) Remove three screws (9) securi bracket and component assembly (10) to fro



Note. Prefix all reference designations for manual V/H
ntrol panel module A5A4 with 7A5A4.
Transistor (Q1) (1)
Heat sink (1)
Zener diode (VR2) (1)
Resistor (R5) (1)
Resistor (R6) (1)
Amplifier (AR1) (1)
Pad (1)
Zener diode (VR1) (1)
Capacitor (C1) (1)
Resistor (R1) (1)
Resistor (R4) (1)
Resistor (R2 and R3) (2)
Capacitor (C2) (1)
Board (1)

Figure 5-35. Manual V/H control panel module 7A5A4, parts location diagram.

ate (23). Remove bracket and component assembly (10) from front plate (23).

(6) Remove terminal (11) and three nuts (12) from bracket and component assembly (10).

(7) Unsolder and carefully mark or tag all electrical connections to connector 3J1 (13). Remove connector 3J1 (13) by removing four screws (14), terminal (15) and four nuts (16).

(8) Remove four rivets (17) securing two springs (18) to rear plate (19). Remove two springs (18) from rear plate (19).

(9) Remove four cups (20), four studs (21) and four springs (22) from front plate (23).

b. Reassembly. To reassemble the photo control panel, proceed as follows:

NOTE

Refer to the wiring diagram (fig. 3-8) to obtain correct electrical connections and parts location.

(1) Install four springs (22), four studs (21) and four cups (20) to front plate (23).

(2) Install two springs (18) to rear plate (19), using four rivets (17).

(3) Position connector 3J1 (13) in its proper location on rear plate (19). Install connector 3J1 (13), using four screws (14), terminal (15) and four nuts (16).

(4) Solder appropriate electrical connections to connector 3J1 (13).

(5) Install nuts (12) and terminal (11) in bracket and component assembly (12).

(6) Install bracket and component assembly (10) to front plate (23), using three screws (9).

(7) Install tubing (8), if removed, to each spacer (6).

(8) Install four spacers (6) to front plate (23) and rear plate (19), using eight screws (7).

(9) Install plates (5 and 4) to cover (1).

(10) Install two grommets (3) and two captive fasteners (2) in cover (1).

(11) Refer to paragraph 3-14*b* for procedures completing reassembly of photo control panel.

5-35. Photo System Assembly (Unit 1) Disassembly and Reassembly
(fig. 5-37)

a. Disassembly. To disassemble the photo system assembly, proceed as follows:

(1) Perform paragraph 3-15*a*.

(2) Unsolder and carefully mark or tag all electrical connections to connector 1XA3(3), 1XA1(4), or 1XA2(5).

(3) Remove two screws (1) and two nuts (2) securing each connector 1XA3 (3), 1XA1 (4), or 1XA2 (5) to chassis and clip assembly (12). Remove connector (3, 4, or 5) from chassis and clip assembly (12).

(4) Remove four screws (6), two hooks (7), four nuts (8), screw (9), washer (10), and nut (8) securing front panel plate (11) to chassis and clip assembly (12). Remove front panel plate (11) from chassis and clip assembly (12).

(5) Press out two eyelets (13) and remove clip (14) from chassis and clip assembly (12).

(6) Remove 13 terminals (15) from chassis and clip assembly (12).

(7) Remove two rivets (16) securing each spring (17) to chassis and clip assembly (12). Remove spring (17) from chassis and clip assembly (12).

NOTE

Before removal of connectors, steps (8) through (13) below, notice orientation of connector shell.

(8) Unsolder and carefully mark or tag all electrical connections to connector 1J1 (22).

(9) Remove four screws (18), four washers (19), terminal (20), and four nuts (21) securing connector 1J1 (22) to front panel plate (11). Remove connector 1J1 (22) from front panel plate (11).

(10) Unsolder and carefully mark or tag all electrical connections to connector 1J2 (23).

(11) Remove four screws (18), four washers (19), terminals (20 and 26), terminal board (25), and four nuts (21) securing connector 1J2 (23) to front panel plate (11). Remove connector 1J2 (23) from front panel plate (11).

(12) Unsolder and carefully mark or tag all electrical connections to connector 1J3 (24).

(13) Remove four screws (18), four washers (19), terminal (20), terminal board (25), and four nuts (21) securing connector 1J3 (24) to front panel plate (11). Remove connector 1J3 (24) to front panel plate (11).

(14) Remove two rivets (27) securing each retainer (28) to bracket and guide assembly (29). Remove each retainer (28) from bracket and guide assembly (29).

(15) Remove two rivets (30) securing each spring (31) to bracket and guide assembly (29). Remove each spring (31) from bracket and guide assembly (29).

(16) Press out three grommets (32) from cover (33) and remove three fasteners (34).

(17) Remove two rivets (35) securing each clamp assembly (36) to tray (37). Remove each clamp assembly (36) from tray (37).

b. Reassembly. To reassemble the photo system assembly, proceed as follows:

NOTE

Refer to wiring diagram (fig. 3-14) to obtain correct electrical connections and parts location.

(1) Install each clamp assembly (36) to tray (37), using two rivets (35).

(2) Push in each fastener (34) through each grommet (32) and press-fit grommet (32) and fastener (34) into cover (33).

(3) Install each spring (31) onto bracket and guide assembly (29), using two rivets (30).

(4) Install each retainer (28) to bracket and guide assembly (29), using two rivets (27).

(5) Install connector 1J3 (24) to front pane plate (11), using four screws (18), four washer (19), terminal board (25), terminal (20), an four nuts (21).

(6) Solder appropriate electrical connec tions to connector 1J3 (24).

(7) Install connector 1J2 (23) to fron panel plate (11), using four screws (18), fou washers (19), terminal board (25), terminal (26 and 20), and four nuts (21).

(8) Solder appropriate electrical connection to connector 1J2 (23).

(9) Install connector 1J1 (22) to front pane plate (11), using four screws (18), four washer (19), terminal (20), and four nuts (21).

(10) Solder appropriate electrical connection to connector 1J1 (22).

(11) Install each spring (17) to chassis an clip assembly (12), using two rivets (16).

(12) Press in 13 terminals (15) throug bottom side of chassis and clip assembly (12)

(13) Install clip (14) to chassis and clip as sembly (12), using two eyelets (13) through bot tom side of chassis.

(14) Install front panel plate (11) to chassi and clip assembly (12), using screw (9), washe (10), nut (8), four screws (6), two hooks (7) and four nuts (8).

(15) Install each connector 1XA2(5), 1XA (4), or 1XA3(3) to chassis and clip assembl (12), using two screws (1), and two nuts (2

(16) Solder appropriate electrical connectior to connectors 1XA2(5), 1XA1(4), or 1XA3(3

(17) Refer to paragraph 3-15*b* for proc dures completing reassembly of the photo syste assembly.

Figure 5-36. Photo control panel, exploded view.
[Located in back of manual]

5-36. Photo System Assembly (Unit 1) Intervalometer Module 1A1, Disassembly and Reassembly
(fig. 5-38)

NOTE

The photo system assembly intervalometer module 1A1 (9, fig. 3-20) is removed in paragraph 3-15*a*.

a. Disassembly. To disassemble the photo sy tem assembly intervalometer module 1A1, pr ceed as follows:

NOTE

Prior to removal of parts, remove epoxy coating by applying a small amount of Xylol (Federal Specification TT-X-

916) to the necessary area and brush off with a nonmetallic brush.

(1) Unsolder and carefully mark or tag all ectrical connections to capacitor 1A1C6 (45).

(2) Remove two nuts (31) securing capaci- r 1A1C6 (45) to printed circuit board (46).

(3) Disassembly of remaining parts from tervalometer module 1A1 is obvious from the arts location diagram (fig. 5–38) and upon in- ection of the assembly.

b. Reassembly. To reassemble the photo sys- m assembly intervalometer module 1A1, pro- ed as follows:

NOTE

Refer to wiring diagram (fig. 5–16) to obtain correct electrical connections and parts location.

(1) Install capacitor 1A1C6 (45) to printed rcuit board (46), using two nuts (31).

(2) Solder appropriate electrical connections capacitor 1A1C6 (45).

(3) Reassembly of remaining parts to inter- alometer module 1A1 is obvious from the parts cation diagram (fig. 5–38) and upon inspection f the assembly.

(4) Apply epoxy coating on reassembled arts, refer to paragraph 5–57.

(5) Refer to paragraph 3–15*b* for reassem- y of intervalometer module 1A1 (9, fig. 3–20) photo system assembly.

-37. Photo System Assembly (Unit 1) Film Drive Amplifier Module 1A2, Disassembly and Reassembly (fig. 5–39)

NOTE

The photo system assembly film drive amplifier module 1A2 (10, fig. 3–20) is removed in paragraph 3–15*a*.

a. Disassembly. To disassemble the photo sys- n assembly film drive amplifier module 1A2, oceed as follows:

NOTE

Prior to removal of parts, remove epoxy coating by applying a small amount of Xylol (Federal Specification TT-X-916) to the necessary area and brush off with a nonmetallic brush.

NOTE

Refer to paragraph 5–38*a* for control rectifier assembly 1A2A2 (3) disassembly procedures.

(1) Unsolder and carefully mark or tag all electrical connections to control rectifier assembly 1A2A2 (3).

(2) Remove four screws (1) and four nuts (2) securing control rectifier assembly 1A2A2 (3) to printed circuit board (26). Remove control rectifier assembly 1A2A2 (3) from printed circuit board (26).

(3) Disassembly of remaining party from film drive amplifier module 1A2 is obvious from the parts location diagram (fig. 5–39) and upon inspection of the assembly.

b. Reassembly. To reassemble the photo system assembly film drive amplifier module 1A2, proceed as follows:

NOTE

Refer to wiring diagram (fig. 5–18) to obtain correct electrical connections and parts location.

NOTE

Refer to paragraph 5–38*b* to insure that the control rectifier assembly 1A2A2 is completely assembled.

(1) Install control rectifier assembly 1A2A2 (3) to printed circuit board (26), using four nuts (2) and four screws (1).

(2) Solder appropriate electrical connections to control rectifier assembly 1A2A2 (3).

(3) Reassembly of remaining parts to film drive amplifier module 1A2 is obvious from the parts location diagram (fig. 5–39) and upon inspection of the assembly.

(4) Apply epoxy coating on reassembled parts, refer to paragraph 5–57.

(5) Refer to paragraph 3–15*b* for reassembly of film drive amplifier module 1A2 (10, fig. 3–20) to photo system assembly.

5–38. Film Drive Amplifier Module 1A2 Control Rectifier Assembly 1A2A2, Disassembly and Reassembly (fig. 5–40)

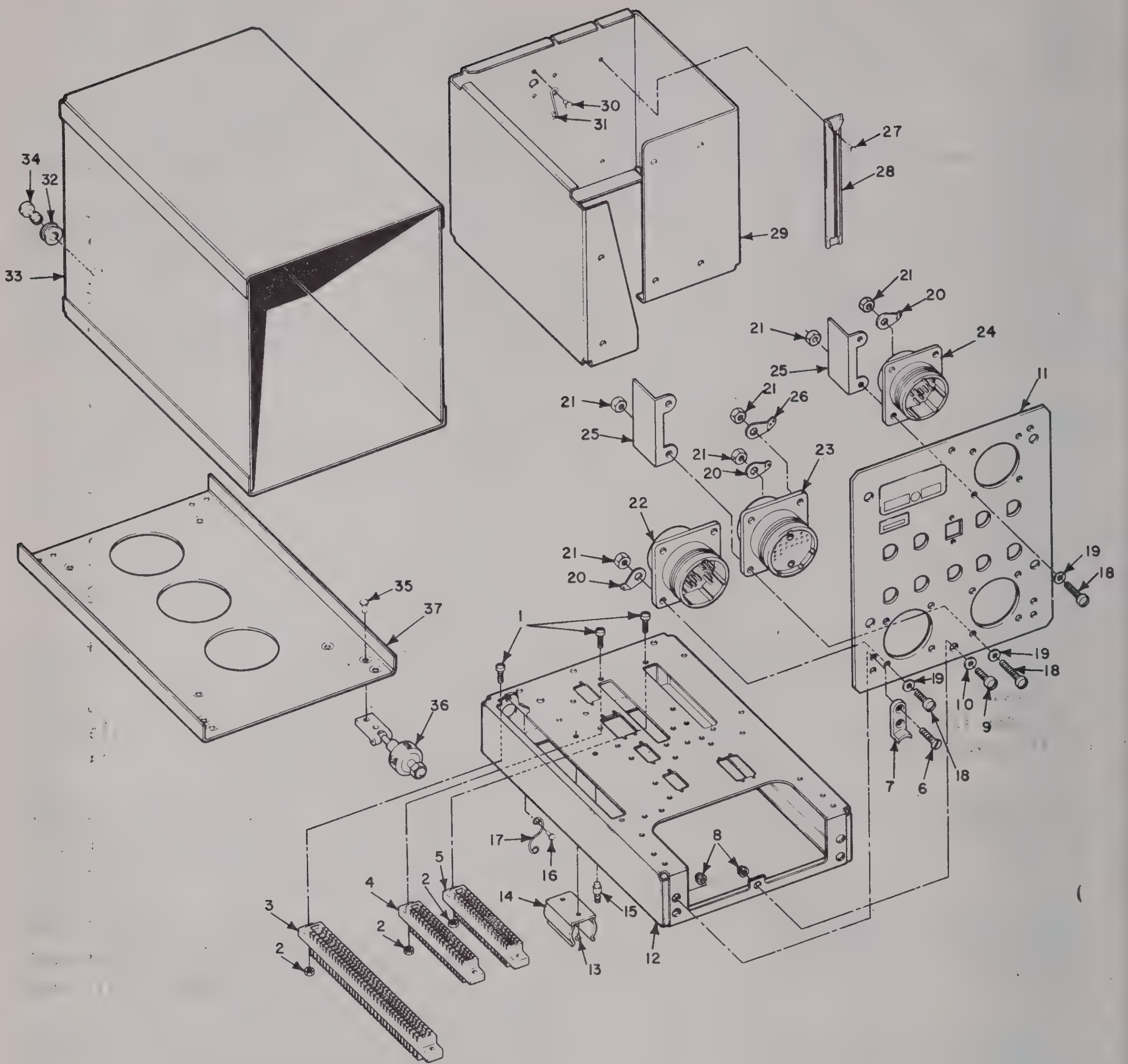
NOTE

The film drive amplifier module control rectifier assembly 1A2A2 (3, fig. 5–39) is removed in paragraph 5–37*a*.

a. Disassembly. To disassemble the control rectifier assembly 1A2A2, proceed as follows:

(1) Remove four screws (1) securing cover (2) to base (25). Remove cover (2) from base (25).

(2) If necessary, remove two rivets (3) securing contact strip (4) to cover (2). Remove contact strip (4) from cover (2).



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Note. Prefix all reference designations for photo system assembly with 1.

1 Screw, machine (6)
2 Nut, hex (6)
3 Connector, pc board (XA3) (1)
4 Connector, pc board (XA1) (1)
5 Connector, pc board (XA2) (1)
6 Screw (4)
7 Hook (2)
8 Nut (5)
9 Screw (1)
10 Washer (1)
11 Front panel plate (1)
12 Chassis and clip assembly (1)
13 Eyelet (2)
14 Clip (1)
15 Terminal (13)
16 Rivet (2)
17 Spring (1)
18 Screw (12)
19 Washer (12)
20 Terminal (3)
21 Nut (12)
22 Connector (J1) (1)
23 Connector (J2) (1)
24 Connector (J3) (1)
25 Terminal board (2)
26 Terminal (1)
27 Rivet (12)
28 Retainer (6)

Figure 5-37. Photo system assembly, exploded view.

) Bracket and guide assembly (1)
) Rivet (6)
. Spring (3)
: Grommet (3)
: Cover (1)
34 Fastener (3)
35 Rivet (4)
36 Clamp assembly (2)
37 Tray (1)

Figure 5-37—Continued.

NOTE

Prior to removal of liquid staked parts, remove solidified staking by applying a small amount of Xylol (Federal Specification TT-X-916) with nonmetallic brush.

(3) Unsolder and carefully mark or tag all ectrical connections to six capacitors 1A2A2C1 rough 1A2A2C6 (5).

(4) Remove six capacitors 1A2A2C1 rough 1A2A2C6 (5) by removing six nuts (5) d six washers (6).

(5) Unsolder and carefully mark or tag all ectrical connections to transformer 1A2A2T1 3).

(6) Remove two screws (7), screw (9), ree nuts (8), and two washers (11) securing ounting bracket (10) and transformer 1A2A2- l (13) to base (25). Remove mounting bracket 0) and transformer 1A2A2T1 (13) from base 5).

(7) Unsolder and remove two resistors 1A- 2R1 and 1A2A2R2 (12) from transformer 2A2T1 (13).

(8) Unsolder and carefully mark or tag all ctrical connections to four coils 1A2A2L1 rough 1A2A2L4 (14).

(9) Remove eight standoffs (15) only if cessary.

(10) Unsolder and carefully mark or tag all ctrical connections to each transistor 1A2A2Q1 1A2A2Q2 (16).

(11) Remove nut (16), lockwasher (17), sher (18), and terminal (19) securing each nsistor 1A2A2Q1 or 1A2A2Q2 (16) to base). Remove each transistor (16) from base).

(12) Unsolder and remove network 1A2A2- (22).

(13) Unsolder and carefully mark or tag all ctrical connections to each diode 1A2A2CR1 or 2A2CR2 (20).

(14) Remove nut (20) and two washers (20) uring each diode 1A2A2CR1 or 1A2A2CR2) to base (25). Remove each diode (20) and insulators (21) from base (25).

(15) Remove two rivets (23) securing bracket (24) to base (25). Remove bracket (24) from base (25).

b. Reassembly. To reassemble the control rectifier assembly 1A2A2, proceed as follows:

(1) Install bracket (24) to base (25), using two rivets (23).

(2) Install diodes 1A2A2CR1 and 1A2A2-CR2 (20) through insulator (21), bracket (24), and insulator (21). Secure each diode (20), using two washers (20) and nut (20). Torque each nut (20) from 12 to 15 inch-pounds.

(3) Install each transistor 1A2A2Q1 or 1A-2A2Q2 (16) through terminal (19), insulator (21), bracket (24), and insulator (21). Secure each transistor (16), using washer (18), lockwasher (17), and nut (16). Torque each nut (16) from 20 to 30 inch-pounds.

(4) Carefully solder all electrical connections and network 1A2A2A1 (22) to diodes 1A-2A2CR1 and 1A2A2CR2 (20) and transistors 1A2A2Q1 and 1A2A2Q2 (16).

(5) Install eight standoffs (15) on mounting bracket (10). Carefully solder four coils 1A-2A2L1 through 1A2A2L4 (14) to their respective standoffs (15).

(6) Install transformer 1A2A2T1 (13) and mounting bracket (10) to base (25), using screw (9), two washers (11), two screws (7), and three nuts (8).

(7) Carefully solder two resistors 1A2A2R1 and 1A2A2R2 (12) and all electrical connections to transformer 1A2A2T1 (13).

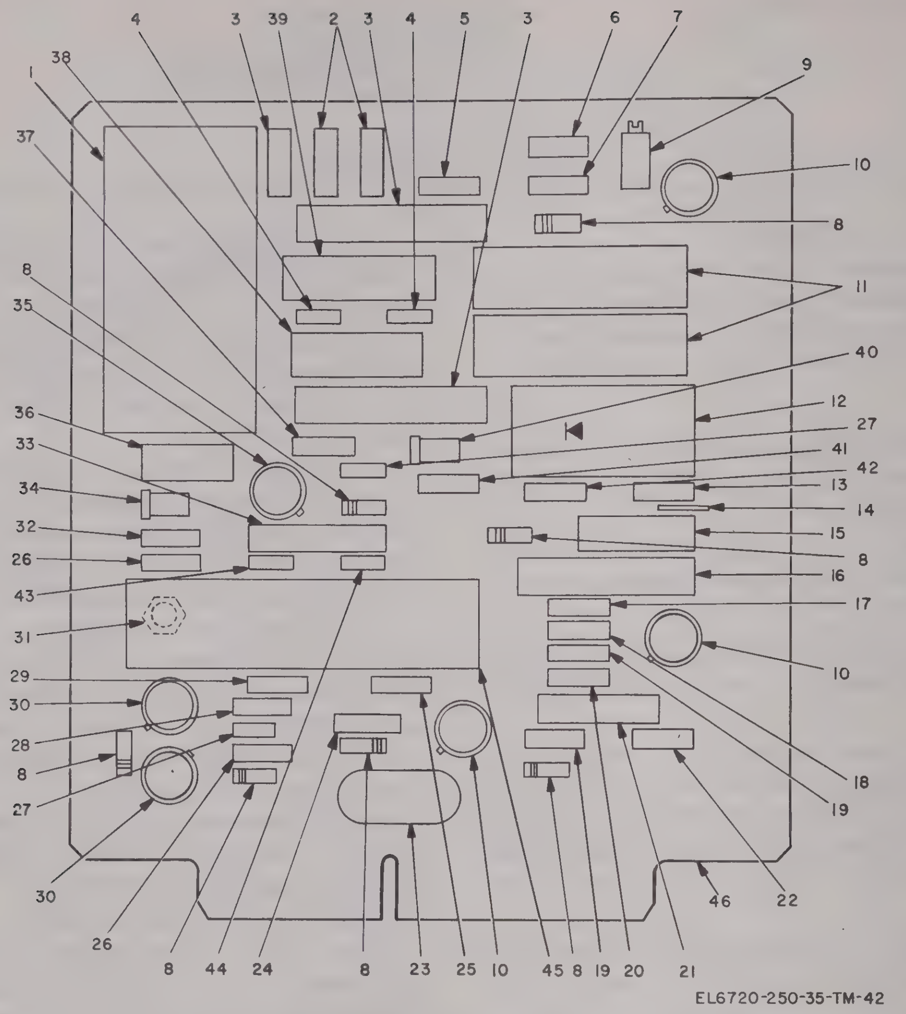
(8) Install six capacitors 1A2A2C1 through 1A2A2C6 (5), using six washers (6) and six nuts (5). Liquid stake capacitors to mounting bracket (10).

(9) Carefully solder all electrical connections to capacitors 1A2A2C1 through 1A2A2C6 (5).

(10) Install contact strip (4) to cover (2), using two rivets (3).

(11) Install cover (2) to base (25), using four screws (1).

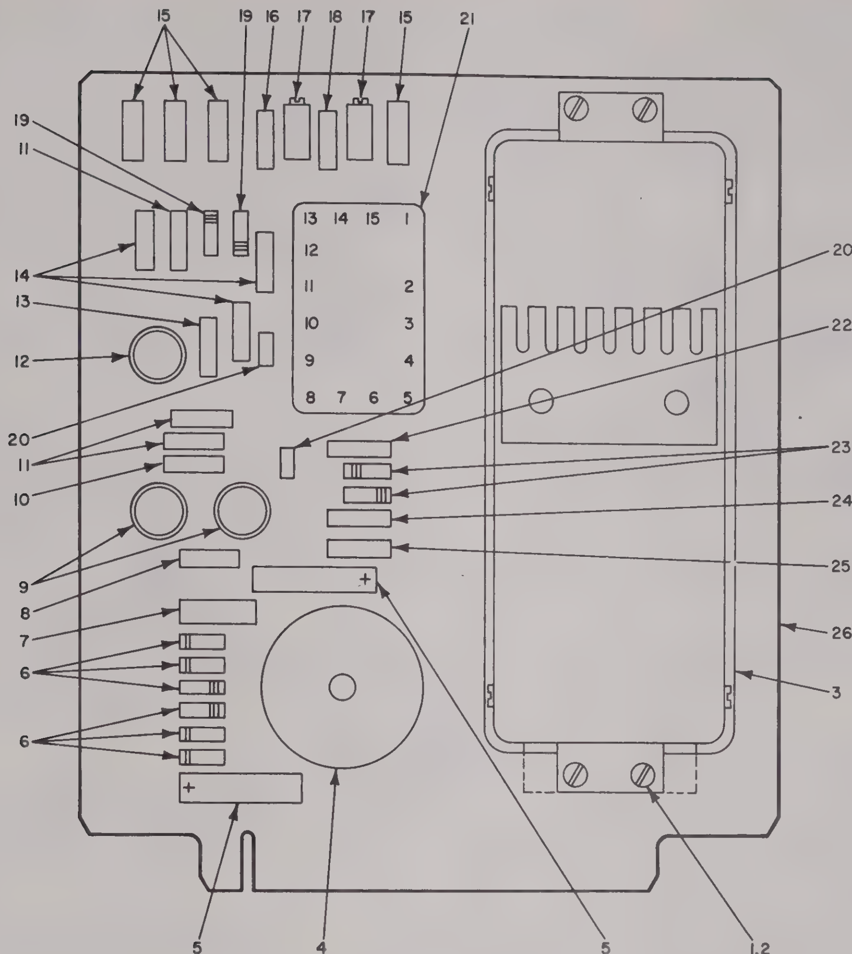
(12) Refer to paragraph 5-37*b* for reassembly of control rectifier assembly (3, fig. 5-39) to film drive amplifier module 1A2.



Note. Prefix all reference designations for photo system assembly intervalometer module A1 with 1A1.

1 Encapsulated preamplifier package (A1) (1)
2 Test jack (TP1, TP2, TP3) (3)
3 Resistor (R2, R8) (2)
4 Diode (CR1, CR12), (2)
5 Resistor (R6) (1)
6 Resistor (R12) (1)
7 Resistor (R9) (1)
8 Diode (CR3, CR5, CR8 through CR11, CR16) (7)
9 Resistor (R21) (1)
10 Transistor (Q4, Q5, Q6) (3)
11 Capacitor (C1, C5) (2)
12 Diode (CR7) (1)
13 Resistor (R7) (1)
14 Thermister (RT1) (1)
15 Resistor (R14) (1)
16 Capacitor (C4) (1)
17 Resistor (R10) (1)
18 Resistor (R15) (1)
19 Resistor (R23, R25) (2)
20 Resistor (R24) (1)
21 Capacitor (C7) (1)
22 Resistor (R13) (1)
23 Relay (K1) (1)
24 Resistor (R18) (1)
25 Resistor (R16) (1)
26 Resistor (R17, R22) (2)
27 Diode (CR4, CR15) (2)
28 Resistor (R19) (1)
29 Resistor (R11) (1)
30 Transistor (Q2, Q3) (2)
31 Nut (2)
32 Resistor (R5) (1)
33 Capacitor (C3) (1)
34 Diode (CR6) (1)
35 Transistor (Q1) (1)
36 Resistor (R26) (1)
37 Resistor (R4) (1)
38 Resistor (R1) (1)
39 Resistor (R20) (1)
40 Diode (CR2) (1)
41 Capacitor (C2) (1)
42 Resistor (R3) (1)
43 Diode (CR14) (1)
44 Diode (CR13) (1)
45 Capacitor (C6) (1)
46 Printed circuit board (1)

Figure 5-38. Photo system assembly intervalometer module 1A1, parts location diagram.



Note. Prefix all reference designations for photo system assembly film drive amplifier module A2 with 1A2.

	Screw (4)	14	Resistor (R3, R4, R8) (3)
	Nut (4)	15	Test jack (TP1 through TP4) (4)
	Control rectifier assembly (A2) (1)	16	Resistor (R14) (1)
	Transformer (T1) (1)	17	Variable resistor (R9, R13) (2)
	Capacitor (C2, C3) (2)	18	Resistor (R10) (1)
	Diode (CR1 through CR6) (6)	19	Diode (CR9, CR10) (2)
	Capacitor (C4) (1)	20	Capacitor (C1, C5) (2)
	Resistor (R16) (1)	21	Transistor and thermistor assembly (A1) (1)
	Transistor (Q1, Q2) (2)	22	Resistor (R18) (1)
	Resistor (R1) (1)	23	Diode (CR11, CR12) (2)
	Resistor (R5, R6, R15) (3)	24	Resistor (R17) (1)
	Transistor (Q3) (1)	25	Resistor (R7) (1)
	Resistor (R2) (1)	26	Printed circuit board (1)

Figure 5–39. Photo system assembly film drive amplifier module 1A2, parts location diagram.

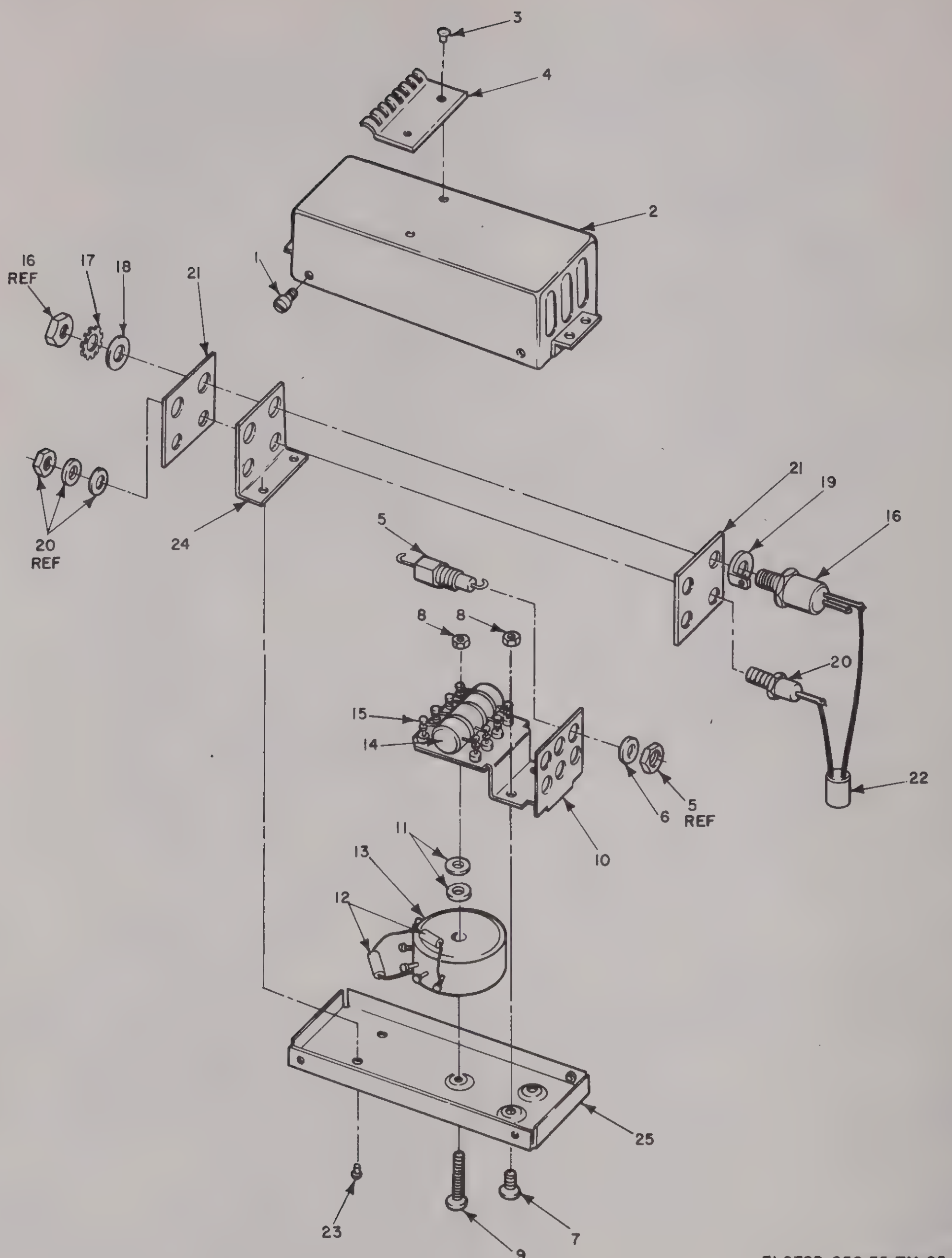
39. Photo System Assembly (Unit 1) Printed Circuit Board and Component Assembly Module 1A3, Disassembly and Reassembly
(fig. 5–41)

NOTE

The photo system assembly printed circuit board and component assembly module 1A3 (11, fig. 3–20) is removed in paragraph 3–15*a*.

NOTE

Prior to removal of parts, remove epoxy coating by applying a small amount of Xylol. (Federal Specification TT–X–916) to the necessary area and brush off with a nonmetallic brush.



Note. Prefix all reference designations for film drive amplifier module 1A2 control rectifier assembly with 1A2A2.

1 Screw (4)
2 Cover (1)
3 Rivet (2)
4 Contact strip (1)
5 Capacitor (C1 through C6) (6) (nut supplied with capacitor)
6 Washer (6)
7 Screw (2)
8 Nut (3)
9 Screw (1)
10 Mounting bracket (1)
11 Washer (2)
12 Resistor (R1, R2) (2)
13 Transformer (T1) (1)
14 Coil (L1 through L4) (4)
15 Standoff (8)
16 Transistor (Q1, Q2) (2) (nut supplied with transistor)
17 Lockwasher (2)
18 Washer (2)
19 Terminal (2)
20 Diode (CR1, CR2) (2) (hardware supplied with diode)
21 Insulator (2)
22 Network (A1) (1)
23 Rivet (2)
24 Bracket (1)
25 Base (1)

Figure 5-40. Film drive amplifier module 1A2 control rectifier assembly 1A2A2, exploded view.

a. Disassembly. Disassembly of parts from printed circuit board and component assembly module 1A3 is obvious from the parts location diagram (fig. 5-41) and upon inspection of the assembly.

b. Reassembly. To reassemble the photo system assembly printed circuit board and component assembly module 1A3, proceed as follows:

NOTE

Refer to wiring diagram (fig. 5-19) to obtain correct electrical connections and parts location.

(1) Reassembly of parts to printed circuit board and component assembly module 1A3 is obvious from the parts location diagram (fig. 5-41) and upon inspection of the assembly.

(2) Apply epoxy coating on reassembled parts, refer to paragraph 5-57.

(3) Refer to paragraph 3-15*b* for reassembly of printed circuit board and component assembly module 1A3 (11, fig. 3-20) to photo system assembly.

5-40. Rotary Mount Actuator (Unit 2), Disassembly and Reassembly

(fig. 5-42)

a. Disassembly. To disassemble the rotary mount actuator, proceed as follows:

(1) Remove five screws (1) and five washers (2) securing top cover (3) and top cover gasket (4) to housing (98). Remove top cover (3) and top cover gasket (4) from housing (98).

(2) Unsolder and carefully mark or tag all electrical connections to electronic circuit assembly 2A1 (8).

(3) Remove five screws (5), five washers (6), and five washers (7) securing electronic circuit assembly 2A1 (8) to housing (98). Remove electronic circuit assembly 2A1 (8) from housing (98).

NOTE

For disassembly of electronic circuit assembly 2A1 (8), refer to paragraph 5-41*a*.

CAUTION

Electrical connections are made to parts mounted on inside of end cover (26). Use care when moving end cover (26) away from housing (98) to prevent damage to wiring.

(4) Remove four screws (9) and four washers (10) securing end cover (26) and end cover gasket (11) to housing (98). Carefully move end cover (26) away from housing (98) as to allow access to electrical connections.

(5) Unsolder and carefully mark or tag all electrical connections to parts mounted on inside of end cover (26). Remove end cover gasket (11).

(6) Remove two nuts (12) securing index potentiometer 2R6 (12) to end cover (26). Remove index potentiometer 2R6 (12) from end cover (26).

(7) Remove screw (13) and washer (14) securing cable clamp (15) to end cover (26). Remove cable clamp (15) from end cover (26).

(8) If necessary, unsolder and remove resistor 2R5 (16) from terminals on end cover (26).

(9) If necessary, unsolder and remove resistor 2R7 (17) from terminals on end cover (26).

(10) If necessary, unsolder and remove two capacitors 2C8 and 2C10 (18) from terminals on end cover (26).

(11) Unsolder and carefully mark or tag electrical connections to resistor 2R4 (21).

(12) Remove screw (19) and washer (20) securing resistor 2R4 (21) to end cover (26). Remove resistor 2R4 (21) from end cover (26).

(13) Remove five threaded insulated terminals 2E1 through 2E5 (22) and one ground lug (23) from end cover (26).

(14) Remove three rivets (24) securing support bracket (25) to end cover (26). Remove support bracket (25) from end cover (26).

(15) Unsolder and carefully mark or tag electrical connections to connector 2P1 (27). Remove connector 2P1 (27) and grommet (28) from pendant cable.

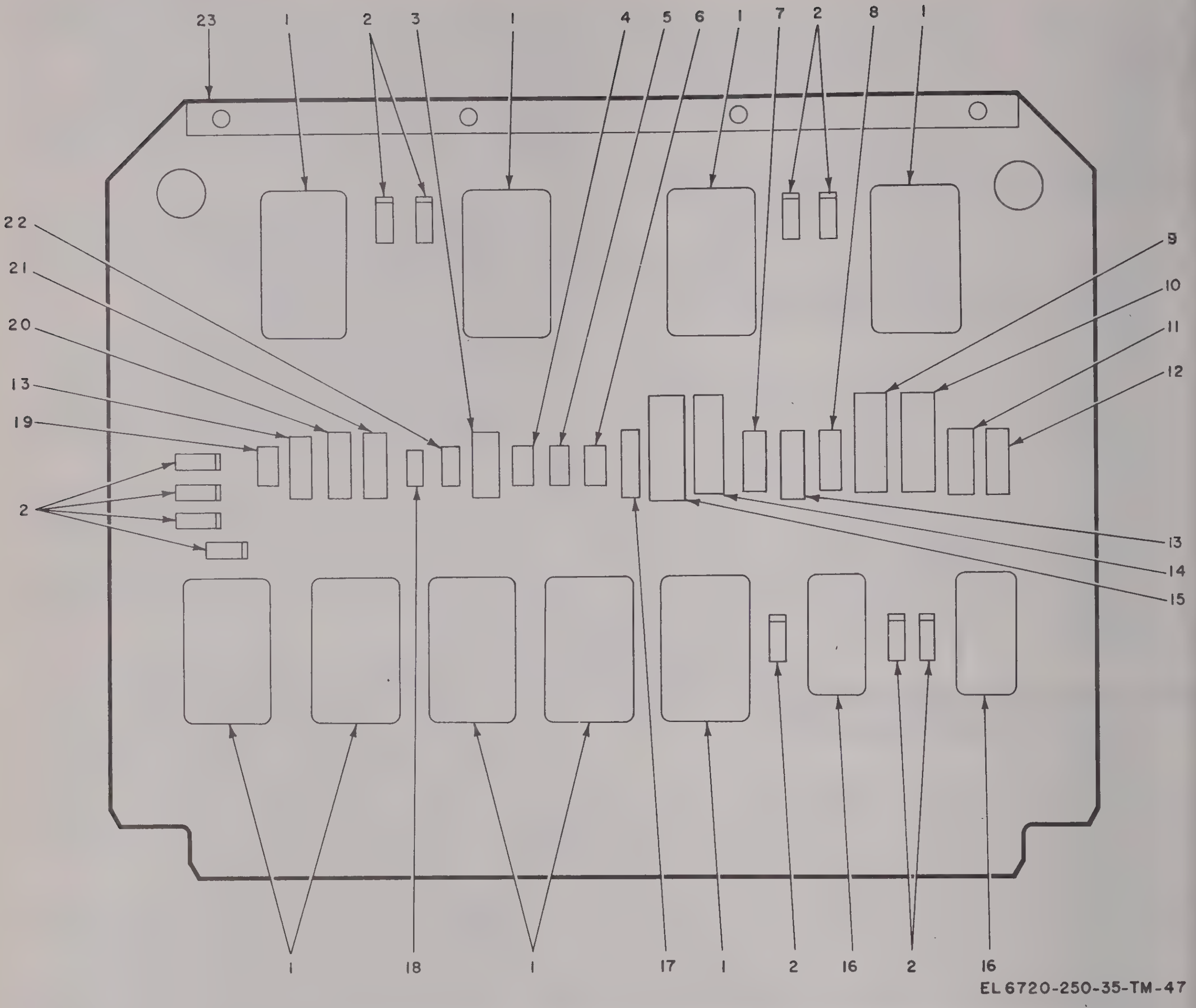
(16) Unsolder and carefully mark or tag electrical connections to filter 2FL1 (31).

(17) Remove two nuts (29) and two washers (30) securing filter 2FL1 (31) to housing (98). Remove filter 2FL1 (31) from housing (98).

CAUTION

Electrical connections are made to parts mounted on mounting plate (46). Use care when moving mounting plate (46) away from housing (98) to prevent damage to wiring.

(18) Remove two screws (32) and two washers (33) securing mounting plate (46) to housing (98). Carefully move mounting plate (46) away from housing (98) to allow access to electrical connections.



Note. Prefix all reference designations for printed circuit board and component assembly module A3 with 1A3.

1	Relay (K1 through K4, K7 through K11) (9)	13	Resistor (R6, R19) (2)
2	Semiconductor device (CR1 through CR11) (11)	14	Resistor (R8) (1)
3	Resistor (R14) (1)	15	Resistor (R9) (1)
4	Resistor (R13) (1)	16	Relay (K5, K6) (2)
5	Resistor (R12) (1)	17	Resistor (R10) (1)
6	Resistor (R11) (1)	18	Resistor (R16) (1)
7	Resistor (R7) (1)	19	Resistor (R20) (1)
8	Resistor (R5) (1)	20	Resistor (R18) (1)
9	Resistor (R4) (1)	21	Resistor (R17) (1)
10	Resistor (R3) (1)	22	Resistor (R15) (1)
11	Resistor (R2) (1)	23	Printed circuit board (1)
12	Resistor (R1) (1)		

Figure 5-41. Photo system assembly printed circuit board and component assembly module 1A3, parts location diagram.

(19) Unsolder and carefully mark or tag all electrical connections to parts mounted on mounting plate (46).

(20) Remove gear clamp (34) securing antibacklash gear assembly (35) to shaft of limit switch 2S1 (43). Remove antibacklash gear assembly (35) from shaft of limit switch 2S1 (43).

(21) Remove gear clamp (36) securing antibacklash gear assembly (37) to shaft of follow-

up potentiometer 2R3 (42). Remove antibacklash gear assembly (37) from shaft of followup potentiometer 2R3 (42).

(22) Unsolder and remove two capacitors 2C3 and 2C7 (38) from followup potentiometer 2R3 (42) and terminal lug (45).

(23) Remove three screws (39), three washers (40), and three clamps (41) securing followup potentiometer 2R3 (42) to mounting plate (46). Remove followup potentiometer 2R3 (42) from mounting plate (46).

(24) Remove three screws (39), three washers (40), and three clamps (41) securing limit switch 2S1 (43) to mounting plate (46). Remove limit switch 2S1 (43) from mounting plate (46).

(25) Remove screw (44) securing terminal lug (45) to mounting plate (46). Remove terminal lug (45) from mounting plate (46).

(26) Remove screw (47), washer (48), and washer (49) securing pinion gear (50) to spline shaft (54). Remove pinion gear (50) and washer (51) from spline shaft (54).

(27) Remove retaining ring (52) and washer (53) securing spline shaft (54) in housing (98). Remove spline shaft (54), key (55), cluster gear (56), and washer (51) from housing (98).

(28) Remove bearing (57), bearing (58), and bearing (59) from housing (98).

(29) Remove three screws (60), three washers (61), screw (62), and washer (63) securing end cover (64) and end cover gasket (65) to housing (98). Remove end cover (64) and end cover gasket (65) from housing (98).

CAUTION

Electrical connections are made to parts mounted on power assembly (69). Use care when moving power assembly (69) away from housing (98) to prevent damage to wiring.

(30) Remove two screws (66), two bushings (67), and screw (68) securing power assembly (69) to housing (98). Carefully remove power assembly (69) from housing (98) to allow access to electrical connections.

(31) Unsolder and carefully mark or tag all electrical connections to power assembly (69).

NOTE

For disassembly of power assembly (69), refer to paragraph 5-42*a*.

(32) Unsolder and carefully mark or tag all electrical connections to dc motor 2B1 (75).

(33) Remove four screws (70) and four washers (71) securing dc motor 2B1 (75) to motor mounting block (80). Remove dc motor 2B1 (75) from motor mounting block (80).

(34) Remove bearing nut (72), worm gear (73), and key (74) from shaft of dc motor 2B1 (75).

(35) Remove three screws (76), three washers (77), screw (78), and washer (79) securing motor mounting block (80) to housing (98). Remove mounting block (80) from housing (98).

(36) Remove nut (81) and taper pin (82) securing worm gear (87) to gear shaft (89). Remove bearing (83), washer (84), washer (85), washer (86), worm gear (87), washer (88), and bearing (83) with gear shaft (89) from housing (98).

(37) Remove two bearings (83), washer (84), washer (85), washer (86), worm gear (87), and washer (88) from gear shaft (89).

(38) Remove two screws (90), and two washers (91) securing shim(s) (92) and bearing block (94) to housing (98). Remove shim(s) (92) and bearing block (94) from housing (98).

(39) Remove bearing (93) from bearing block (94).

(40) Remove four pins (95) from housing (98).

(41) Remove four screws (96) securing nameplate (97) to housing (98). Remove nameplate (97) from housing (98).

b. Reassembly. To reassemble the rotary mount actuator, proceed as follows:

NOTE

Refer to wiring diagram (fig. 5-23) to obtain correct electrical connections and parts location.

(1) Install nameplate (97) to housing (98), using four screws (96).

(2) Install four pins (95) to housing (98).

(3) Install bearing (93) in bearing block (94).

(4) Install bearing block (94) on housing (98), using shim(s) (92), two washers (91), and two screws (90).

(5) Install bearing (83), washer (88), worm gear (87), washer (86), washer (85), washer (84), and bearing (83) on gear shaft (89).

(6) Install gear shaft (89) (with bearings, worm gear, and washers assembled in step (5)) on housing (98).

(7) Install taper pin (82) through worm gear (87) and gear shaft (89), using nut (81).

(8) Install motor mounting block (80) on housing (98), using three washers (77), three screws (76), washer (79) and screw (78).

(9) Install key (74), worm gear (73), and bearing nut (72) on shaft of dc motor 2B1 (75).

(10) Install dc motor 2B1 (75) to motor mounting block (80), using four washers (71) and four screws (70).

(11) Solder all appropriate electrical connections to dc motor 2B1 (75).

NOTE

Perform paragraph 5-42*b* to insure that power assembly (69) is completely assembled.

(12) Solder all appropriate electrical connections to power assembly (69).

(13) Install power assembly (69) on housing (98), using screw (68), two bushings (67), and two screws (66).

(14) Install end cover gasket (65) and end cover (64) to housing (98), using washer (63), screw (62), three washers (61), and three screws (60).

(15) Install bearing (59), bearing (58), and bearing (57) in housing (98).

(16) Position cluster gear (56) and washer (51) in housing (98) between bearing (59) and bearing (58).

(17) Install key (55) in spline shaft (54).

(18) Insert spline shaft (54) in housing (98) through bearing (59), cluster gear (56), washer (51), bearing (58), and bearing (57).

(19) Install washer (53) and retaining ring (52) on spline shaft (54).

(20) Install washer (51), pinion gear (50), washer (49), and washer (48) on spline shaft (54), using screw (47).

(21) Install terminal lug (45) to mounting plate (46), using screw (44).

(22) Install limit switch 2S1 (43) on mounting plate (46), using three clamps (41), three washers (40), and three screws (39).

(23) Loosen three screws (39) installed in step (22) and rotate switch 2S1 housing until switch housing index mark is aligned with mounting plate index mark (fig. 5-43). Tighten screws (39, fig. 5-42).

Figure 5-42. Rotary mount actuator, exploded view. [Located in back of manual]

(24) Install followup potentiometer 2R3 (42) on mounting plate (46), using three clamps (41), three washers (40), and three screws (39).

(25) Solder capacitors 2C3 and 2C7 (38) to appropriate terminals on followup potentiometer 2R3 (42) and terminal lug (45).

(26) Using the multimeter, connect leads between terminals 2 (+) and 6 (−) of followup potentiometer 2R3 (42). Rotate shaft of followup potentiometer 2R3 (42) in either direction until the multimeter indication is at minimum.

NOTE

Do not allow shaft of followup potentiometer 2R3 (42) to turn when installing antibacklash gear assembly (37).

(27) Install antibacklash gear assembly (37) on shaft of followup potentiometer 2R3 (42), using gear clamp (36).

(28) Rotate shaft of limit switch 2S1 (43) clockwise to its mechanical stop. Then rotate shaft of limit switch 2S1 (43) counterclockwise 2 1/2 turns. Continue in the counterclockwise direction until the shaft index mark aligns with switch housing and mounting plate index marks (fig. 5-43).

NOTE

Do not allow shaft of limit switch 2S1 (43) to turn when installing antibacklash gear assembly (35).

(29) Install antibacklash gear assembly (35) on shaft of limit switch 2S1 (43), using gear clamp (34).

(30) Solder all appropriate electrical connections to parts mounted on mounting plate (46).

(31) Install mounting plate (46) on housing (98), using two washers (33) and two screws (32).

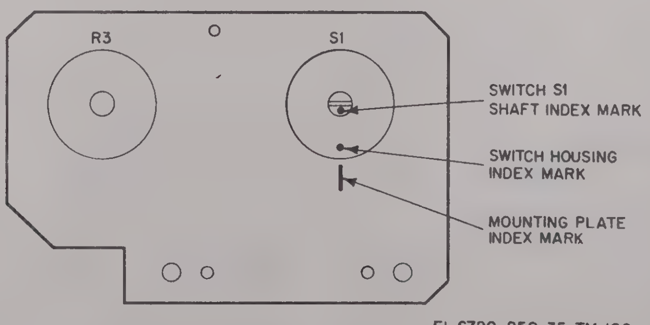


Figure 5-43. Alignment of index marks.

(32) Install filter 2FL1 (31) to housing (98), using two washers (30) and two nuts (29).

(33) Solder all appropriate electrical connections to filter 2FL1 (31).

(34) Route wires which are to be soldered to connector 2P1 (27) through housing (98) and grommet (28). Install grommet (28), in housing (98).

(35) Solder all appropriate electrical connections to connector 2P1 (27).

(36) Install support bracket (25) to end cover (26), using three rivets (24).

(37) Install five threaded insulated terminals 2E1 through 2E5 (22) and ground lug (23) to end cover (26).

(38) Install resistor 2R4 (21) to end cover (26), using washer (20) and screw (19).

(39) Solder all appropriate electrical connections to resistor 2R4 (21).

(40) Solder two capacitors 2C8 and 2C10 (18) to appropriate terminals on end cover (26).

(41) Solder resistor 2R7 (17) to appropriate terminals on end cover (26).

(42) Solder resistor 2R5 (16) to appropriate terminals on end cover (26).

(43) Route appropriate wires through end cover gasket (11) and cable clamp (15).

(44) Install cable clamp (15) to end cover (26), using washer (14) and screw (13).

(45) Install index potentiometer 2R6 (12) to end cover (26), using two nuts (12).

(46) Solder all appropriate electrical connections to parts mounted on end cover (26).

(47) Install end cover gasket (11) and end cover (26) to housing (98), using four washers (10) and four screws (9).

NOTE

Perform paragraph 5-41*b* to insure that electronic circuit assembly 2A1 (8) is completely assembled.

(48) Install electronic circuit assembly 2A1 (8) on housing (98), using five washers (7), five washers (6), and five screws (5).

(49) Solder all appropriate electrical connections to electronic circuit assembly 2A1 (8).

(50) Install top cover gasket (4) and top cover (3) on housing (98), using five washers (2) and five screws (1).

5-41. Rotary Mount Actuator (Unit 2), Electronic Circuit Assembly 2A1, Disassembly and Reassembly
(fig. 5-44)

NOTE

The electronic circuit assembly 2A1 (8, fig. 5-42) was removed in paragraph 5-40*a*.

a. Disassembly. To disassemble the rotary mount actuator electronic circuit assembly 2A1, proceed as follows:

(1) Remove RTV potting compound as required.

(2) Unsolder and carefully mark or tag one end of six bare wire leads interconnecting upper board assembly (7) to lower board assembly (6).

(3) Unsolder and carefully mark or tag capacitor 2A1C14 (8) lead interconnecting upper board assembly (7) to lower board assembly (6).

(4) Remove four screws (1), four lockwashers (2), and four flat washers (3) and remove upper board assembly (7) from insulation plate (5) and lower board assembly (6).

NOTE

Make certain four spacers (4) are retained on the insulation plate (5).

(5) Disassembly of remaining parts of electronic circuit assembly 2A1 is obvious from the exploded view (fig. 5-44) and upon inspection of the assembly.

b. Reassembly. To reassemble the rotary mount actuator electronic circuit assembly 2A1, proceed as follows:

NOTE

Refer to wiring diagram (fig. 5-24) to obtain correct electrical connections and parts location.

(1) Carefully mate lower board assembly (6) to insulation plate (5) and upper board assembly (7).

NOTE

Make certain four screw mounting holes of both boards are properly aligned with holes of four spacers (4) retained on insulation plate (5).

(2) Install four lockwashers (2) four flat washers (3), and four screws (1) into four mounting holes of both the upper and lower board assemblies. Rotate screws clockwise until assemblage is tightly secured together.

(3) Solder capacitor 2A1C14 (8) leads between appropriate eyelets of upper and lower board assemblies.

(4) Solder six bare wire leads annotated in *a* (2) above to appropriate eyelets of upper or lower board assemblies as required.

(5) Using RTV compound, pot entire assembly.

(6) Reassembly of remaining parts to electronic circuit assembly 2A1 is obvious from the exploded view (fig. 5-44) and upon inspection of the assembly.

(7) Refer to paragraph 5-40*b* for reassembly of electronic circuit assembly 2A1 (8, fig. 5-42) to rotary mount actuator.

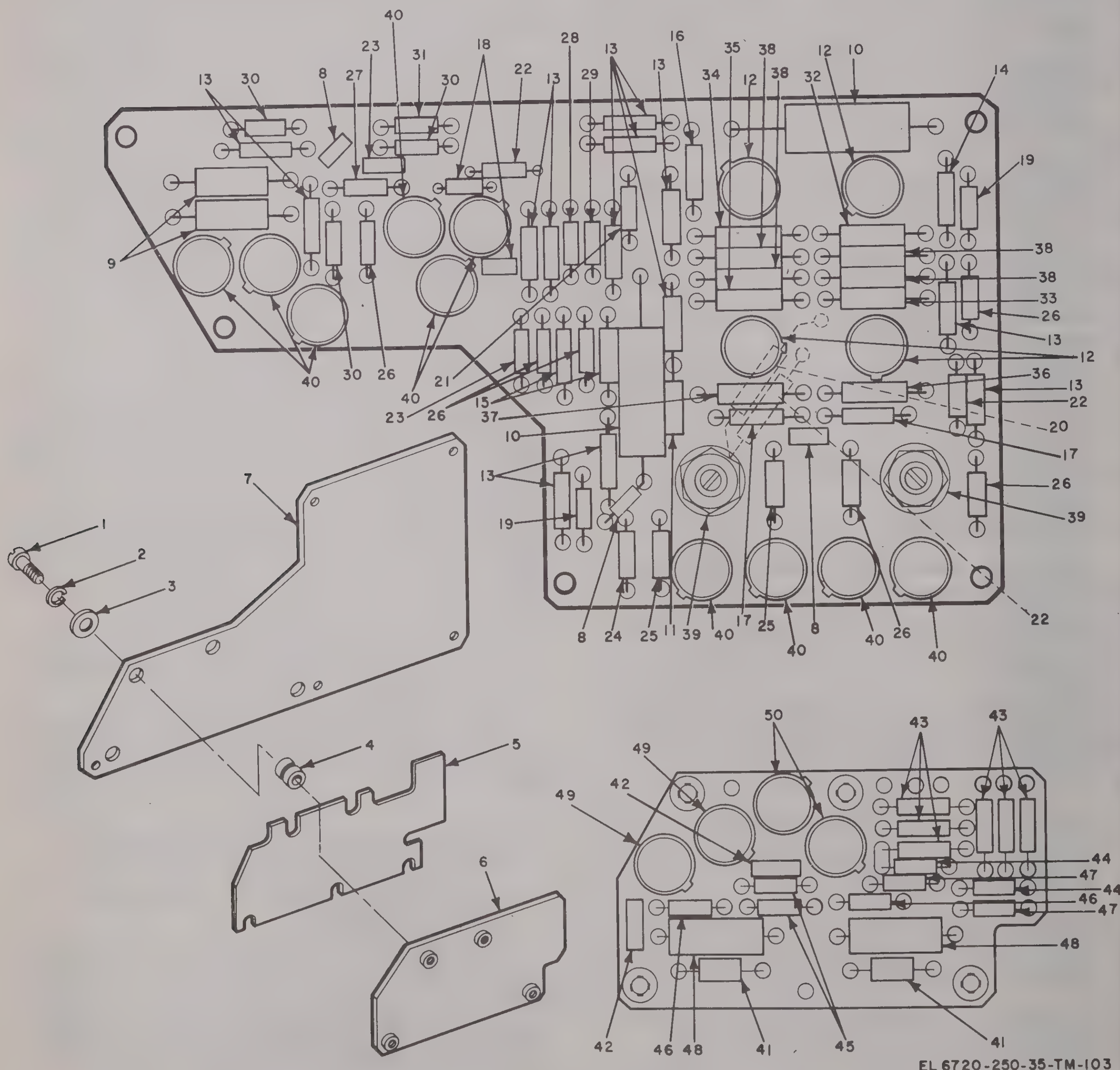
5-42. Rotary Mount Actuator (Unit 2) Power Assembly, Disassembly and Reassembly (fig. 5-45)

NOTE

The power assembly (69, fig. 5-42) was removed in paragraph 5-40*a*.

a. Disassembly. To disassemble the power assembly, proceed as follows:

(1) Remove six screws (1) and carefully remove terminal board (6).



Note. Prefix all reference designations for electronic circuit assembly A1 with 2A1.

Figure 5-44. Rotary mount actuator electronic circuit assembly 2A1, exploded view.

1 Screw (4)
2 Washer, lock (4)
3 Washer, flat (4)
4 Spacer (4)
5 Plate insulation (1)
6 Lower board assembly (1)
7 Upper board assembly (1)
8 Capacitor (C4, C13, C14) (3)
9 Capacitor (C7, C8) (2)
10 Capacitor (C1, C2) (2)
11 Capacitor (C5) (1)
12 Comparator, differential (AR1 through AR4) (4)
13 Diode (CR2 through CR4, CR7 through CR12 CR16, CR19, CR22, CR23) (13)
14 Diode (CR25) (1)
15 Diode (CR5, CR6) (2)
16 Diode (CR1) (1)
17 Diode (CR21, CR24) (2)
18 Capacitor (C11, C12) (2)
19 Resistor (R18, R41) (2)
20 Capacitor (C15) (1)
21 Resistor (R3) (1)
22 Resistor (R16, R28, R48) (3)
23 Resistor (R22, R29) (2)
24 Resistor (R19) (1)
25 Resistor (R17, R35) (2)
26 Resistor (R6, R7, R10, R13, R43, R44) (6)
27 Resistor (R34) (1)
28 Resistor (R21) (1)
29 Resistor (R20) (1)
30 Resistor (R31, R36, R37) (3)
31 Resistor (R30) (1)
32 Resistor (R4) (1)
33 Resistor (R47) (1)
34 Resistor (R9) (1)
35 Resistor (R33) (1)
36 Resistor (R15) (1)
37 Resistor (R46) (1)
38 Resistor (R5, R8, R32, R40) (4)
39 Resistor (R25, R42) (2)
40 Transistor (Q1, Q4 through Q11, Q14) (10)
41 Capacitor (C3, C10) (2)
42 Capacitor (C6, C9) (2)
43 Diode (CR13 through CR15, CR17, CR18, CR20) (6)
44 Resistor (R14, R38) (2)
45 Resistor (R24, R27) (2)
46 Resistor (R12, R39) (2)
47 Resistor (R11, R45) (2)
48 Resistor (R23, R26) (2)
49 Transistor (Q3, Q13) (2)
50 Transistor (Q2, Q12) (2)

Figure 5-44—Continued.

CAUTION

Do not attempt to remove completely; lead wiring will limit travel distance of terminal board (6).

(2) Unsolder and carefully mark or tag all electrical connections to terminal board (6) and four terminals (5).

(3) Unsolder resistor 2R1 (2), capacitor 2C1 (3), and resistor 2R2 (4) from terminal board (6).

(4) Unsolder six diodes 2CR1 through 2CR6 (7) from terminal board (12).

(5) Unsolder and carefully mark or tag all electrical connections to pulse transformers 2T1 and 2T2 (8). Remove pulse transformers 2T1 and 2T2 (8) from terminal board (12).

(6) Unsolder and carefully mark or tag all electrical connections to 18 terminals (11) of terminal board (12).

(7) Remove four screws (9) and remove terminal board (12) and three spacer posts (10).

(8) Unsolder and carefully mark or tag all electrical connections to four terminal lugs (17) and four silicon control rectifiers 2CR7 through 2CR10 (18).

NOTE

To assist in reassembly, note flat side orientation of four mica insulator washers (16) prior to removal.

(9) Remove nut (13), washer (14), shouldered insulator washer (15), insulator washer (16), and terminal lug (17) securing each silicon control rectifier (18). Remove four silicon control rectifiers 2CR7 through 2CR10 (18) from transformer mounting plate (31).

(10) Unsolder and carefully mark or tag all electrical connections to two terminal lugs (22).

(11) Remove nut (19), lockwasher (20), and screw (21) securing two terminal lugs (22). Remove two terminal lugs (22).

(12) Unsolder and remove four capacitors 2C4 through 2C6 and 2C9 (23) from terminals of power transformer 2T3 (26).

(13) Unsolder and carefully mark or tag all electrical connections to power transformer 2T3 (26).

(14) Remove four nuts (24) and four lockwashers (25) securing power transformer 2T3 (26). Remove power transformer 2T3 (26).

(15) Remove screw (27) and remove spacer block (28) from transformer mounting plate (31).

(16) Remove screw (29) and remove spacer block (30) from transformer mounting plate (31).

b. Reassembly. To reassemble the power assembly, proceed as follows:

NOTE

Refer to wiring diagram (fig. 5-23) to obtain correct electrical connections and parts location.

(1) Install spacer block (30) to transformer mounting plate (31), using screw (29).

(2) Install spacer block (28) to transformer mounting plate (31), using screw (27).

(3) Install power transformer 2T3 (26) to transformer mounting plate (31), using four lockwashers (25) and four nuts (24).

(4) Solder appropriate electrical connections, removed in *a* (13) above, to power transformer 2T3 (26).

(5) Solder four capacitors 2C4 through 2C6 and 2C9 (23) to appropriate terminals on power transformer 2T3 (26).

(6) Install two terminal lugs (22) to transformer mounting plate (31), using screw (21), lockwasher (20), and nut (19).

(7) Solder appropriate electrical connections, removed in *a* (10) above, to two terminal lugs (22).

NOTE

Coat both sides of four mica insulator washers (16) with potting compound prior to installation at four silicon control rectifiers (18).

(8) Install four silicon control rectifiers 2C-R7 through 2CR10 (18) to transformer mounting plate (31), using four terminal lugs (17), four insulator washers (16), four shouldered insulator washers (15), four washers (14), and four nuts (13).

(9) Solder appropriate electrical connections to four terminal lugs (17) and four silicon control rectifiers 2CR7 through 2CR10 (18).

(10) Install three spacer posts (10) onto terminal board (12), using three screws (9); then secure assembly to spacer block (28), using screw (9).

(11) Solder appropriate electrical connections to 18 terminals (11) of terminal board (12).

(12) Install pulse transformers 2T1 and 2T2 (8) on terminal board (12) and solder pulse transformer leads to appropriate terminals (11). Coat transformer leads with epoxy adhesive as required.

NOTE

Observe diode polarity when attaching in position.

(13) Solder six diodes 2CR1 through 2CR6 (7) to terminals (11) of terminal board (12).

(14) Solder resistor 2R1 (2), capacitor 2C1 (3) and resistor 2R2 (4) to terminal board (6).

(15) Solder appropriate electrical connections to terminals (5) of terminal board (6).

(16) Install terminal board (6), using six screws (1).

(17) Refer to paragraph 5-40*b* for reassembly of power assembly (69, fig. 5-42) to rotary mount actuator.

5-43. Door Actuator (Unit 4), Disassembly and Reassembly
(fig. 5-46)

The left, right, and vertical door actuators are identical.

a. Disassembly. To disassemble the door actuator, proceed as follows:

(1) Remove the snap cover (1) by grasping the edges with the fingertips and pulling upward.

(2) Remove two screws (2) securing cover (5). Remove cover (5).

(3) If necessary, remove two screws (3) and two rings (4).

(4) Unsolder and carefully mark or tag all electrical connections to filter 4FL1 (6).

(5) Remove filter (6) by lifting up and out.

(6) Remove four screws (7) from two spacers (67 and 68).

(7) Remove four screws (8) from end fitting (9).

(8) Remove end fitting (9). Loosen setscrew (10) and remove radial bearing (11) from fitting.

(9) Remove four screws (12) and four washers (13) from switchplate (16). Remove junction box (14) and retaining plate (15).

(10) Remove two nuts (18) and two washers (19) from two screws (17).

(11) Remove terminal (20), contact (21), switch 4S2 (22), contact (21), switch 4S1 (22) and four spacers (23).

(12) Remove switchplate (16) and remove bushing (53) from switchplate (16).

(13) Remove two screws (24 and 25) from support block (26), and lift the support block (26) from traveler screws (32 and 33).

(14) Remove two rods (27 and 28) from support block (26). Remove four guides (29) from support block (26).

(15) Remove four travelers (30 and 31) from four traveler screws (32 and 33), respectively.

(16) Remove three screws (34) and plate (35), and remove four spacers (36), shims (37), and four traveler screws (32 and 33) from support block (38).

(17) Remove two screws (39), two washers (40), and two washers (41) from support plate (45), and remove switch 4S3 (42), contact (43), and retaining plate (44).

(18) Remove support plate (45), four ball bearings (46 and 47), three shim washers (48 and 49), two spur gears (50 and 51), and four spacers (52).

(19) Remove dowel pin (54) from bearing shaft (97) and remove helical gear (55) and shims (56). Unscrew retainer nut (57) from flange clutch (64). Remove washer assembly (58) and five spring washers (59, 60, and 61) from bearing shaft (97).

CAUTION

Twelve steel ball bearings (105) will fall out of the flange clutch (64) when the flange clutch (64) is removed. Do not lose the ball bearings (105).

(20) Remove spur gear (62), shim (63), flange clutch (64), and woodruff key (65) from bearing shaft (97).

(21) Remove two screws (66) from two spacers (67 and 68) and two screws (69) from support plate (70). Remove two spacers (67 and 68), support plate (70), retaining plate (71), and cover plate (72).

(22) Remove nut (74) and washer (75) from screw (76), and remove support block (77) and clamp (78). Remove motor 4B1 (73).

(23) Loosen nut (80), and unscrew fitting assembly (79) from nut tube (89). Remove tab washer (81) .

(24) Unscrew stop nut (82) from guide housing (88). Remove two washers (83), spacer (84), and packing ring (85) from stop nut (82).

(25) Gently push nut tube (89) through guide housing (88) in the direction of guide flange (90). Remove two pins (86) and (106). Remove sleeve spacer (87) from guide housing (88).

(26) Unscrew nut tube (89) from acme nut (91) and unscrew acme nut (91) from acme screw (92).

(27) Remove stop washer (93) and two shims (94 and 95) from acme screw (92). Slide sleeve spacer (96) from bearing shaft (97) and remove two shims (98 and 99). Remove two ball bearings (100) from both ends of bearing shaft (97). Remove thrust washer (101) and shim (102).

(28) Remove pin (103) from bearing shaft (97) and remove acme screw (92) from bearing shaft (97). Remove plug (104) from acme screw (92).

b. Reassembly. To reassemble the door actuator, proceed as follows:

(1) Insert plug (104) in acme screw (92) and insert both in bearing shaft (97). Align all parts and pin them in place with pin (103).

(2) Slip ball bearing (100) over threaded end of acme screw (92). Lubricate ball bearing with 1 or 2 drops of lubricating oil, general purpose.

(3) Slip four shims (94, 95, 98, and 99) next to ball bearing (100) and stop washer (93) next to shim.

(4) Slip shim (102), thrust washer (101), and ball bearing (100), over threaded end of bearing shaft (97), and position sleeve spacer (96) over two ball bearings, shims, and spacers.

(5) Screw acme screw (92) through acme nut (91), and screw acme nut (91) into nut tube (89).

NOTE

Coat the acme screw (92) with a generous amount of grease, molybdenum disulfide.

(6) Position pin (86) into acme nut (91) and insert in guide housing (88). Insert pin (106) in guide housing (88).

(7) Insert sleeve spacer (87) in the threaded end of guide housing (88).

(8) Position the entire assembly through the guide flange (90).

(9) Place packing ring (85) into stop nut (82). Place washer (83), spacer (84), and washer (83) into stop nut (82).

(10) Screw stop nut (82) to guide housing (88).

(11) Place nut (80) on fitting assembly (79). Place tab washer (81) on fitting assembly (79), making sure that the key and keyway are aligned.

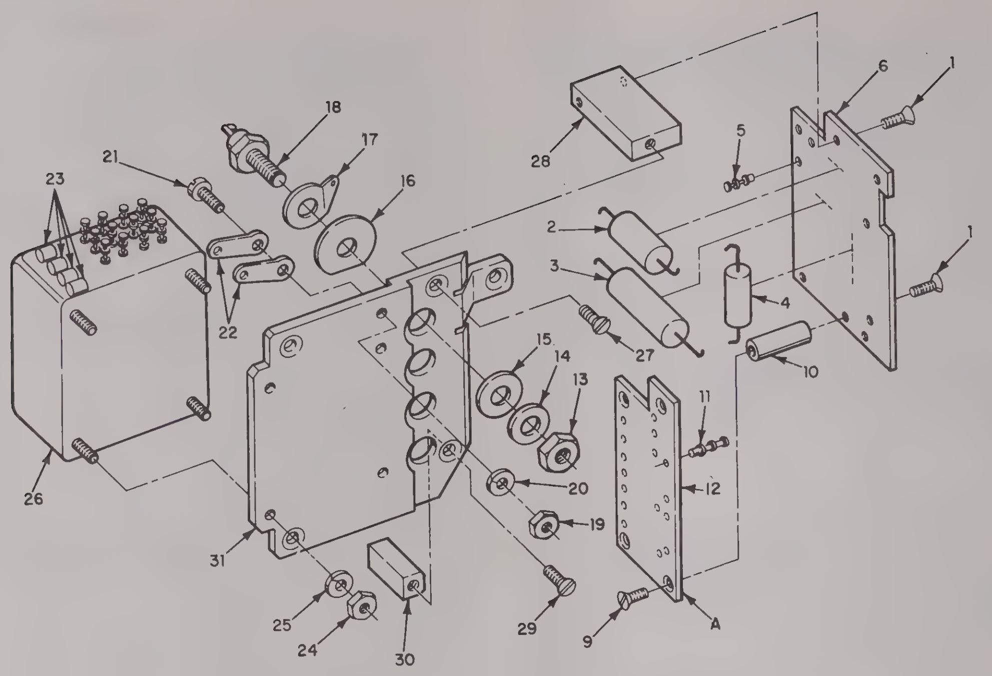
(12) Screw fitting assembly (79) into nut tube (89).

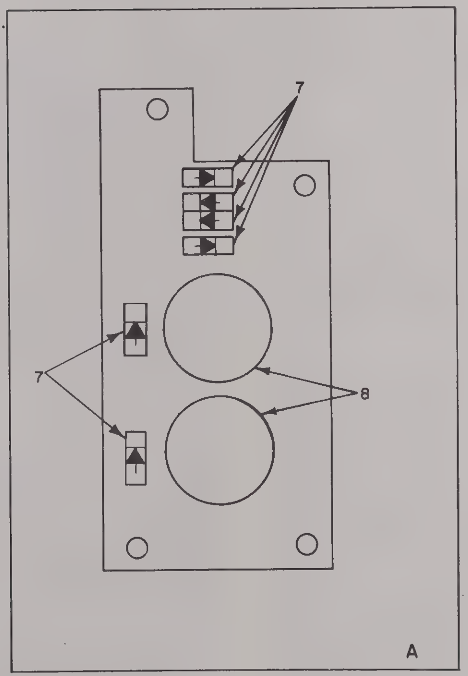
NOTE

Perform paragraph 5–44*b* to insure that motor 4B1 (73) is completely assembled.

(13) Slide clamp (78) over motor 4B1 (73) and guide housing (88). Insert screw (76) through clamp (78), support block (77), and flat washer (75). Fasten nut (74) to the end of screw (76). Do not tighten at this time.

(14) Place support plate (70), cover plate (72), and retaining plate (71) in the order of removal. Insert wires from the motor through the





EL6720-250-35-TM-104

1 Screw (6)
2 Resistor (2R1) (1)
3 Capacitor (2C1) (1)
4 Resistor (2R2) (1)
5 Terminal (4)
6 Board, terminal (1)
7 Diode (2CR1 through 2CR6) (6)
8 Transformer, Pulse (2T1, 2T2) (2)
9 Screw (4)
10 Post, spacer (3)
11 Terminal (18)
12 Board, terminal (1)
13 Nut (4)
14 Washer, flat (4)
15 Washer, insulator, shouldered (4)
16 Washer, insulator (4)
17 Terminal lug (4)
18 Rectifier, silicon (2CR7 through 2CR10) (4)
19 Nut (1)
20 Washer, lock (1)
21 Screw (1)
22 Terminal lug (2)

Figure 5-45. Rotary mount actuator power assembly, exploded view.

23 Capacitor (2C4, 2C5, 2C6, 2C9) (4)
24 Nut (4)
25 Washer, lock (4)
26 Transformer, power (2T3) (1)
27 Screw (1)
28 Block, spacer (1)
29 Screw (1)
30 Block, spacer (1)
31 Plate, transformer mounting (1)

Figure 5-45—Continued.

appropriate holes in the plates, and position the plates against motor mounting plate.

(15) Insert two screws (69) through motor mounting plate, cover plate (72), and retaining plate (71), and secure to support plate (70).

(16) Insert two screws (66) through motor mounting plate, cover plate (72), retaining plate (71), and support plate (70), and secure to two spacers (67 and 68).

(17) Holding flange clutch (64) with the threaded shank facing upward, place shim (63) over the shank. Place 12 steel ball bearings (105) into the holes on the circular face of flange clutch (64). Place spur gear (62) over the shank of flange clutch, and align the holes in spur gear with 12 steel ball bearings.

(18) Place five spring washers (61, 60, and 59) and washer assembly (58) over the shank of flange clutch (64) in the order or removal. Screw retainer nut (57) onto the threaded end of the shank of flange clutch (64) until 12 steel ball bearings (105) are firmly retained between flange clutch (64) and spur gear (62).

(19) Place woodruff key (65) into the keyway of bearing shaft (97) and place the assembled parts (step (18), above) onto the bearing shaft (97).

NOTE

Be careful when securing the flange clutch (64) over the woodruff key.

(20) Place required number of shims (56) and helical gear (55) on bearing shaft (97), and insert dowel pin (54). Place bushing (53) over the end of the helical gear (55).

NOTE

Shims are required for 0.002-to 0.005-inch end play.

Figure 5-46. Door actuator, exploded view.
[Located in back of manual]

(21) With the cutout side of support block (38) facing upward, fit four traveler screws (33 and 32) through the holes in the support block. Place required number of shims (37) and four spacers (36) on the end of gear assembly and secure plate (35) to support block (38) using three screws (34).

NOTE

The required number of shims have been placed on the gear assembly when there is no evidence of end play within the block after the plate has been secured.

(22) Insert two screws (17) through switchplate (16), four spacers (23), switch 4S1 (22), contact (21), switch 4S2 (22), contact (21), terminal (20), and two washers (19), and secure using two nuts (18).

(23) Insert radial bearing (11) in end fitting (9) and tighten setscrew (10).

(24) Insert two screws (8) through the bottom holes of guide flange (90), retaining plate (71), support plate (70), two spacers (52), switchplate (16), and retaining plate (15), and screw loosely into the bottom holes of end fitting (9).

(25) Screw four travelers (30 and 31) onto four traveler screws (32 and 33), and take care to mesh the four traveler screws with helical gear (55).

(26) Place four guides (29) into the appropriate holes of support block (26), and insert two rods (27 and 28).

(27) Slide support block (26) onto four traveler screws (32 and 33).

(28) Insert two screws (8) through the upper holes of guide flange (90), retaining plate (71), support plate (70), two spacers (52), switchplate (16), and retaining plate (15), and screw loosely into the top holes of end fitting (9).

(29) Insert two screws (39) through four washers (40 and 41), switch 4S3 (42), contact (43), and retaining plate (44), and screw into support plate (45).

(30) Insert four screws (7) through the retaining plate (15) and switchplate (16), and screw into two spacers (67 and 68).

(31) Place shim washer (49) and two ball bearings (47) on the shaft of spur gear (51) in the order of removal, and fit ball bearings into the appropriate holes between support plates (70 and 45).

(32) Place two shim washers (48) and two ball bearings (46) on the shaft of spur gear (50) in the order of removal, and fit ball bearings in their appropriate mounting holes between support plates (70 and 45).

(33) Tighten four screws (8) and screw (76).

(34) Fit filter 4FL1 (6) between two spacers (67 and 68). Secure junction box (14) to retaining plate (15) and switchplate (16) using four screws (12) and four washers (13).

(35) Reconnect all electrical wiring to switches 4S1 through 4S3 (22 and 42) and filter 4FL1 (6).

(36) Insert adjustment screws (25 and 24).

(37) Insert two rings (4) and two screws (3) on support block (26).

(38) Place cover (5) over the main assembly and secure it in place into support block (26), using two screws (2).

(39) Snap cover (1) into cover (5) on the top of the assembly.

5–44. Door actuator (Unit 4) Motor and Brake Assembly, Disassembly and Reassembly (fig. 5–47)

NOTE

The motor and brake assembly (73, fig. 5–46) was removed in paragraph 5–43*a*.

a. Disassembly. To disassemble the door actuator motor and brake assembly, proceed as follows:

(1) Cut the safety wire connecting four mounting screws (1) on both brush cap covers (2) on either side of end housing (38).

(2) Remove four mounting screws (1) securing both brush cap covers (2). Remove each brush cap cover (1).

(3) Pull out two insulators (3) and remove two retaining screws (4).

(4) Lift out both brush assemblies (5) from both brush holders (7 and 8) and lay them carefully aside.

(5) Remove two holding screws (11) securing cover (12). Remove cover (12).

(6) Carefully remove retaining ring (13).

(7) Unsolder and carefully mark or tag all electrical connections to coil assembly (15). Grasp the inner hub of brake core (14) and firmly, but carefully, pull it out of brake housing (28) without damaging the electrical wiring passing through the slot.

(8) Remove spring (16) and set aside.

Figure 5–47. Door actuator motor and brake assembly, exploded view.
[Located in back of manual]

(9) Remove brake disc assembly, which consists of brake disc (17) and brake washer (18) bonded together.

(10) Pull or pry off retaining ring (19) from shaft of armature (32) and remove the shim set (20).

(11) Gently pull off brake disc (21) from the shaft of armature (32). Be careful to retain key (22).

(12) Remove the shim set (23) from brake housing (28).

(13) Remove spacer (24) from brake housing (28).

(14) Cut safety wires connecting two mounting screws (26) to drive screw (25).

(15) Remove two mounting screws (26), two retaining lugs (27), and drive screw (25).

(16) Firmly grasp housing assembly (33) and slowly remove brake housing (28) from housing assembly (33). Be careful not to damage shaft of armature (32).

(17) Remove bushing (29) from brake housing (28) only if it is absolutely necessary.

(18) Remove ball bearing (30) and hubbed bushing (31) from shaft of armature (32).

(19) Remove armature (32).

(20) Remove ball bearing (36) and flat washer (35) from shaft of armature (32).

(21) Gently and firmly separate the housing assembly (33) from end housing (42). Be careful not to damage the electrical wiring. Disconnect the motor field winding leads.

(22) Unsolder and carefully mark or tag all electrical connections to terminal (10) and loosen two screws (6). Push brush holder (7 and 8) out from inside of end housing (42). Remove brush holder (8) from insulator (9).

(23) Unsolder and carefully mark on tag capacitor 4C1 (41) electrical leads. Remove screw (39) and capacitor 4C1 (41), retrieving the terminal (40).

(24) Remove retaining screw (38).

(25) Remove bushing (37) from end housing (42) only if it is absolutely necessary.

b. Reassembly. To reassemble the door actuator motor and brake assembly, proceed as follows:

(1) Check to see that bushing (37) is firmly seated in its mounted position within end housing (42). If loose, secure bushing (37) in place with sealing compound and press to seat it.

(2) Insert retaining screw (38) bottoming at bushing (37).

(3) Inspect brush holder (8), making certain that the brush holder (8) is firmly seated

in the insulator (9), and that terminal (10) is soldered properly in place.

(4) Insert brush holder (8) in the brush receptacle hole nearest the wiring access on end housing (42); secure it in place by applying lacquer to screw (6), and tighten screw (6).

(5) Insert brush holder (7) in the other brush receptacle hole of end housing (42); secure it in place by applying lacquer to screw (6), and tighten screw (6).

(6) Hold capacitor 4C1 (41) and terminal (40) in place within end housing (42), and secure them, using screw (39). The lip of terminal (40) must face toward end housing wall.

(7) Solder leads of capacitor 4C1 (41) and leads of brush terminal (10), and pass housing assembly (33) leads through the wiring access on end housing (42).

(8) Insert housing assembly (33), with the attached field assembly, in end housing (42).

(9) Place flat washer (35) and ball bearing (36) on shaft of armature (32) (commutator end). Apply grease, aircraft and instrument, to ball bearing (36).

(10) Firmly grasping housing assembly (33), insert armature (32), taking care not to damage ball bearing (36). See that ball bearing (36) is seated properly into bushing (37).

(11) Check to see that bushing (29) is bonded securely in place within brake housing (28). If it is not, secure it in place with sealing compound, and press to seat it.

(12) Place hubbed bushing (31) and ball bearing (30) on the exposed shaft of armature (32). Apply grease, aircraft and instrument, to ball bearing (30).

(13) Carefully join brake housing (28) to housing assembly (33), properly seating ball bearing (30) into bushing (29).

(14) Apply antiseize compound to the threads of two mounting screws (26). Pass one screw through retaining lug (27), brake housing (28), housing assembly (33), and into end housing (42). Position retaining lug (27) in place, and tighten mounting screw (26).

(15) Insert a length of safety wire through the other mounting screw (26) and tighten securely in place.

(16) Twist safety wire and secure it separately to drive screw (25). Tighten drive screw (25).

(17) Insert spacer (24) all the way into brake housing (28).

(18) Install shim set (23) firmly against spacer (24). Select correct number of shims that will allow 0.003-to 0.010-inch brake airgap when the brake is energized.

(19) Place brake disc (21) on shaft of armature (32), align the keyway troughs and insert key (22).

(20) Secure brake disc (21) to shaft of armature (32) by slipping shim set (20) on the shaft and pressing retaining ring (19) into place. Add as many shim sets (20) to the shaft as necessary to prevent armature end play prior to securing retaining ring (19).

(21) Inspect the brake disc assembly, making certain that brake washer (18) and brake disc (17) are bonded together securely. If they are not, bond by moistening the adhesive film with cleaning compound and applying light pressure.

(22) Center the brake disc assembly on brake disc (21).

(23) Place spring (16) into its groove in brake disc (17).

(24) Inspect brake core (14) and coil assembly (15), assuring a tight seating and contact of coil assembly into brake core (14). Position brake core (14) and coil assembly (15) on brake disc assembly, firmly seating spring (16). See that the electrical wiring passes through the wiring slot of brake core (14). Connect electrical connections to coil assembly (15).

(25) Stake retaining ring (13) into place.

(26) Apply lacquer to the outer rim of cover (12) and secure it to brake housing (28), using two holding screws (11).

(27) Align two brush assemblies (5) and insert them in brush holders (7 and 8). Secure brushes, using two retaining screws (4).

(28) Place two insulators (3) over both retaining screws (4), and hold in place with both brush cap covers (2). Secure both brush cap covers, using four mounting screws (1).

(29) Install safety wire on four mounting screws (1), two on each brush cap cover (2).

(30) Refer to paragraph 5-43*b* for reassembly of motor and brake assembly (73, fig. 5-46) to door actuator.

5-45. Light Sensor (Unit 5), Disassembly and Reassembly
(fig. 5-48)

The left, right, and vertical light sensors are identical.

a. Disassembly. To disassemble the light sensor, proceed as follows:

(1) Do not disconnect leads from connector 5P1 (4) unless replacement of the connector 5P1 (4) is necessary.

(2) Using a soldering iron, apply heat to liquid-staked strain relief cap (10). Remove strain relief cap (10) from mounting flange (7).

(3) Slide strain relief cap (10) and washer (9) onto cable (11).

(4) Using a soldering iron, apply heat to six liquid-staked screws (5). Remove six screws (5) and then slide mounting flange (7) onto cable (11) away from housing (29).

(5) If photocell assembly (14 through 16) requires replacement, proceed as follows:

(*a*) Remove gasket (12) and cushion (13).

(*b*) Unsolder and carefully mark or tag all electrical connections from cable (11) to cover (14).

(*c*) Remove cable (11), cushion (13), gasket (12), mounting flange (7), seal (8), washer (9), and strain relief cap (10).

(6) Remove spacer (17) and then remove aperture and lenticular plate assembly (19 through 23).

NOTE

Witness mark position of aperture plate (23) with respect to lenticular plate (19). Do not remove or add setscrews (18).

(7) Disassembly of the remaining parts is obvious from the exploded view (fig. 5-48) and upon inspection of the equipment.

b. Reassembly. To reassemble the light sensor, proceed as follows:

NOTE

Refer to wiring diagram (fig. 5-27) to obtain correct electrical connections and parts location.

(1) Install gasket (28), cover glass (27), spacer (26), filter (25), and spacer (24) in housing (29).

(2) If a new lenticular plate (19) is being installed, proceed as follows:

(*a*) Secure lenticular plate (19) to aperture plate (23) using three washers (21), three washers (22), and three screws (20). Do not tighten the screws (20).

CAUTION

Excess tightening of screws (20) will cause lenticular plate (19) to fracture.

(*b*) Shift the position of lenticular plate (19) with respect to aperture plate (23) until chicken wire shadows on lenticular plate (19) are of minimum thickness. Carefully tighten three screws (20).

CAUTION

If aperture and lenticular plate assembly can not be installed in housing (29), slightly readjust position of lenticular plate (19) with respect to aperture plate (23) ((*b*) above).

(3) If the original aperture and lenticular plate assembly is being replaced, install as directed in step (2) except align the lenticular plate (19) and aperture plate (23) by means of their witness marks.

(4) Carefully place aperture and lenticular plate assembly (19 through 23) in housing.

(5) Reinstall spacer (17).

(6) If a new cable is being installed, insert cable (11) through strain relief cap (10), washer (9), seal (8), mounting flange (7), gasket (12), and cushion (13); then solder wire leads to terminals on cover (14). Solder leads as far as possible without applying stress to terminals on cover (14).

NOTE

On some light sensor models, the plate (6) is an integral part of mounting flange (7).

(7) If the original cable is being reconnected, insert cable (11) through seal (8), mounting flange (7), gasket (12), and cushion (13), then solder wire leads as directed in step (6).

NOTE

Use liquid staking on strain relief cap (10).

(8) Position seal (8) and washer (9) on threaded portion of mounting flange (7); then secure strain relief cap (10) to mounting flange (7). Tighten strain relief cap to compress seal (8).

(9) Position photocell assembly (14 through 16), cushion (13), and gasket (12) in housing (29).

NOTE

Use liquid staking on six screws (5).

(10) Secure mounting flange (7) on housing (29), using six screws (5).

5-46. Camera Pulse Panel (134AV81400-1 or 134AV81400-3), (Unit 6) Disassembly and Reassembly

The disassembly and reassembly procedures to be performed by general support maintenance are identical with the disassembly and reassembly procedures performed by direct support maintenance (para 3-16).

5-47. Pod Assembly (Unit 10) Disassembly and Reassembly

Refer to TM 11-6760-228-35-1 for general support disassembly and reassembly procedures on pod assembly.

5-48. Camera (Unit 9), Disassembly and Reassembly

Refer to TM 11-6720-236-35 for general support disassembly and reassembly procedures on camera.

5-49. Camera Mount A (Unit 11), Disassembly and Reassembly (fig. 5-49)

a. Disassembly. To disassemble the camera mount A, proceed as follows:

(1) Remove screw (1), bushing (2), washer (4), and washer (5) securing follower (3) to rotary mount actuator (Unit 2) pinion gear. Remove follower (3) from rotary mount actuator (Unit 2) pinion gear.

(2) Remove four bolts (6) and four washers (7) securing rotary mount actuator (Unit 2) to bracket (25). Remove rotary mount actuator (Unit 2) from bracket (25).

NOTE

For disassembly of rotary mount actuator (Unit 2), refer to paragraph 5-40*a*.

(3) Remove pin (8) from pin (9).

(4) Remove pin (9) from block (18).

(5) Remove knob (10) and washer (11) from fork (32) and block (18).

(6) Remove pin (12) from bolt (13).

(7) Remove bolt (13), washer (14), two spacers (15), washer (14), and nut (16) securing bracket (25) to torque box assembly (59). Remove bracket (25) from torque box assembly (59).

(8) Remove two rivets (17) securing block (18) in channel (23) and channel (24). Remove block (18) from channel (23) and channel (24).

(9) Remove 15 rivets (19) securing plate (20) to channel (23) and channel (24). Remove plate (20) from channel (23) and channel (24).

(10) Remove 15 rivets (19) securing plate (21) to channel (23) and channel (24). Remove plate (21) from channel (23) and channel (24).

(11) Remove six fasteners (22) securing channel (23) to bracket (25). Remove channel (23) from bracket (25).

(12) Remove six fasteners (22) securing channel (24) to bracket (25). Remove channel (24) from bracket (25).

(13) Remove two nuts (26) from fork (32).

(14) Remove pin (27) from bolt (28).

(15) Remove bolt (28), washer (29), spacer (30), washer (29), and nut (31) securing fork (32) to torque box assembly (59). Remove fork (32) from torque box assembly (59).

(16) Remove pin (33) from bolt (34).

(17) Remove bolt (34), plate (35), washer (36), and nut (37) securing two bearings (38) and bushing (39) to torque box assembly (59). Remove two bearings (38) and bushing (39) to torque box assembly (59).

(18) Remove pin (40) from bolt (41).

(19) Remove bolt (41), plate (42), washer (43), and nut (44) securing bushing (45) and bearing (46) to torque box assembly (59). Remove bushing (45) and bearing (46) from torque box assembly (59).

(20) Remove two screws (47), two washers (48), and two nuts (49) securing two clamps (50) to torque box assembly (59). Remove two clamps (50) from torque box assembly (59).

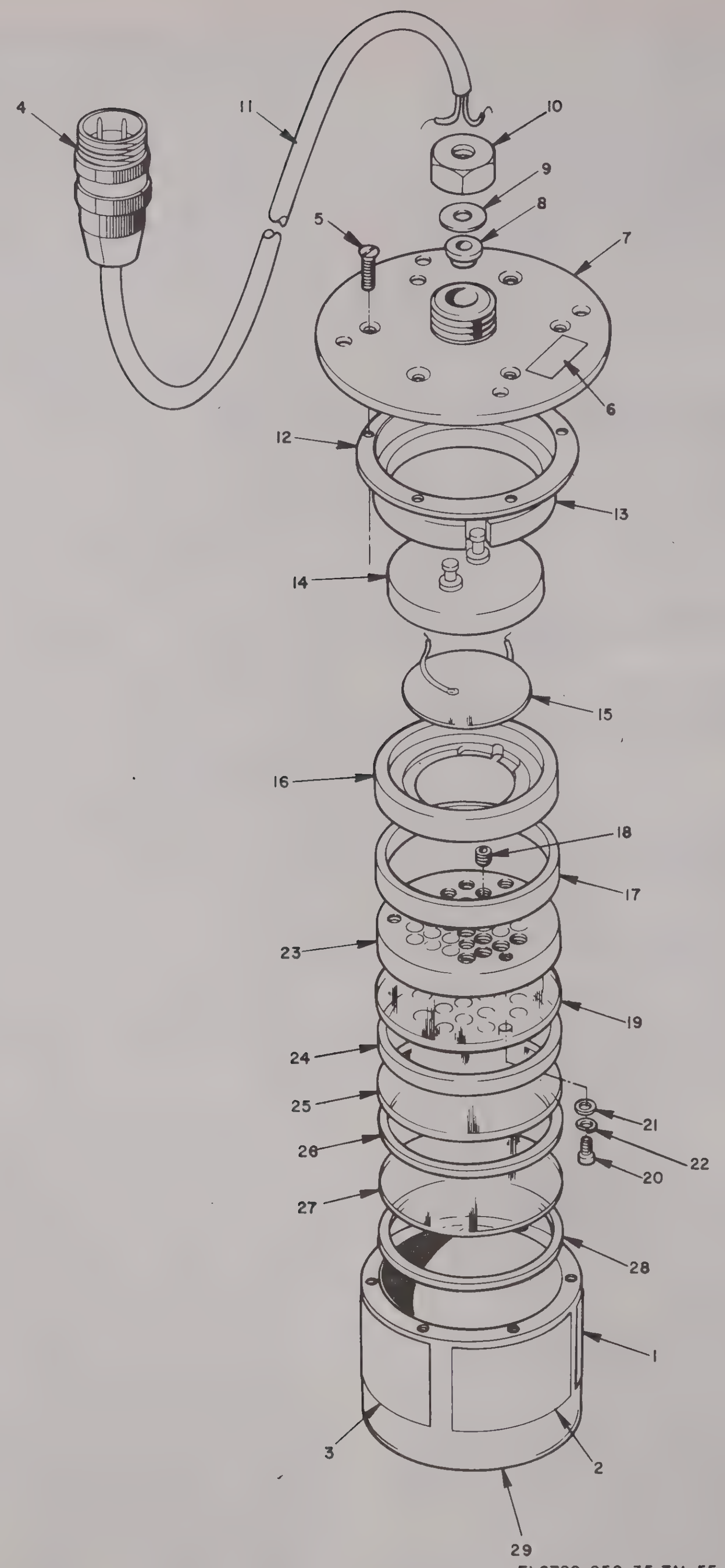
(21) Remove pin (51) securing spacer (52) to pin (53). Remove spacer (52) from pin (53).

(22) Remove pin (53) securing washer (54) and spring (55) to torque box assembly (59). Remove washer (54) and spring (55) from torque box assembly (59).

(23) Uncrimp lanyard (56) and remove from torque box assembly (59).

(24) Remove four rivets (57) securing nameplate (59) to torque box assembly (59). Remove nameplate (58) from torque box assembly (59).

(25) For dissembly of torque box assembly (59), refer to paragraph 5-50*a*.



Note. Prefix all reference designations for the light sensor with 5.

1 Instruction plate (MP10) (1)
2 Identification plate (MP11) (1)
3 Identification plate (MP12) (1)
4 Connector (P1) (1)

Figure 5-48. Light sensor, exploded view.

5 Screw (H1 through H6) (6)
6 Plate (MP16) (1)
7 Mounting flange (MP4) (1)
8 Seal (MP15) (1)
9 Washer (H32) (1)
10 Cap, strain relief (MP1) (1)
11 Cable (20 in.) (1)
12 Gasket (MP7) (1)
13 Cushion (MP2) (1)
14 Cover (A2MP2) (1)
15 Photocell (A2V1) (1)
16 Case (A2MP1) (1)
17 Spacer (MP14) (1)
18 Setscrew (H7 through H31) (25)
19 Lenticular plate (A1MP2) (1)
20 Screw (A1H1 through A1H3) (3)
21 Washer (A1H4 through A1H6) (3)
22 Washer (A1H7 through A1H9) (3)
23 Aperture plate (A1MP1) (1)
24 Spacer (MP13) (1)
25 Filter (MP13) (1)
26 Spacer (MP12) (1)
27 Cover glass (MP6) (1)
28 Gasket (MP5) (1)
29 Housing (MP8) (1)

Figure 5-48—Continued.

b. Reassembly. To reassemble the camera mount A, proceed as follows:

(1) Perform procedure in paragraph 5-50*b* to insure that torque box assembly (59) for the camera mount A, is completely assembled.

(2) Install nameplate (58) on torque box assembly (59), using four rivets (57).

(3) Install and crimp lanyard (56) on torque box assembly (59).

(4) Install spring (55) and washer (54) on torque box assembly (59), using pin (53).

(5) Install spacer (52) on pin (53) using pin (51).

(6) Install two clamps (50) on torque box assembly (59), using two screws (47), two washers (48), and two nuts (49).

(7) Install bearing (46) and bushing (45) on torque box assembly (59), using bolt (41), plate (42), washer (43), and nut (44).

(8) Install pin (40) in bolt (41).

(9) Install bearing (38), bushing (39), and bearing (38) on torque box assembly (59), using bolt (34), plate (35), washer (36), and nut (37).

(10) Install pin (33) in bolt (34).

(11) Install fork (32) on torque box assembly (59), using bolt (28), washer (29), spacer (30), washer (29), and nut (31).

(12) Install pin (27) in bolt (28).

(13) Install two nuts (26) on fork (32).

(14) Install channel (24) on bracket (25), using six fasteners (22).

(15) Install channel (23) on bracket (25), using six fasteners (22).

(16) Install plate (21) on channel (23) and channel (24), using 15 rivets (19).

(17) Install plate (20) on channel (23) and channel (24) using 15 rivets (19).

(18) Install block (18) on channel (23) and channel (24), using two rivets (17).

(19) Install bracket (25) on torque box assembly (59), using bolt (13), washer (14), two spacers (15), washer (14), and nut (16).

(20) Install pin (12) in bolt (13).

(21) Install knob (10) and washer (11) on fork (32) in block (18).

(22) Adjust knob (10) as required. Tighten two nuts (26) on fork (32).

(23) Install pin (9) in block (18).

(24) Install pin (8) in pin (9).

NOTE

Refer to paragraph 5-40*b* to insure that rotary mount actuator (Unit 2) is completely assembled.

(25) Install rotary mount acutator (Unit 2) on bracket (25), using four washers (7) and four bolts (6).

(26) Install follower (3) on rotary mount actuator (Unit 2) pinion gear, using washer (5), washer (4), bushing (2), and screw (1).

5-50. Camera Mount A (Unit 11) Torque Box Assembly, Disassembly and Reassembly

(fig. 5-50 (1) and (2))

a. Disassembly. To disassemble the torque box assembly, proceed as follows:

(1) Perform paragraph 5-49*a*.

(2) Remove two rivets (1) and eight rivets (124) securing bracket (2) to angle (202) and to angle (165). Remove bracket (2) from angle (202) and angle (165).

(3) Remove two rivets (3) securing bracket (4) to fitting (207). Remove bracket (4) from fitting (207).

(4) Remove two rivets (5) securing bracket (6) to cover (38) and cover (32). Remove bracket (6) from cover (38) and cover (32).

(5) Remove four rivets (7) securing support (8) to support (11), bracket (34), and bracket (35). Remove support (8) from support (11), bracket (34), and bracket (35).

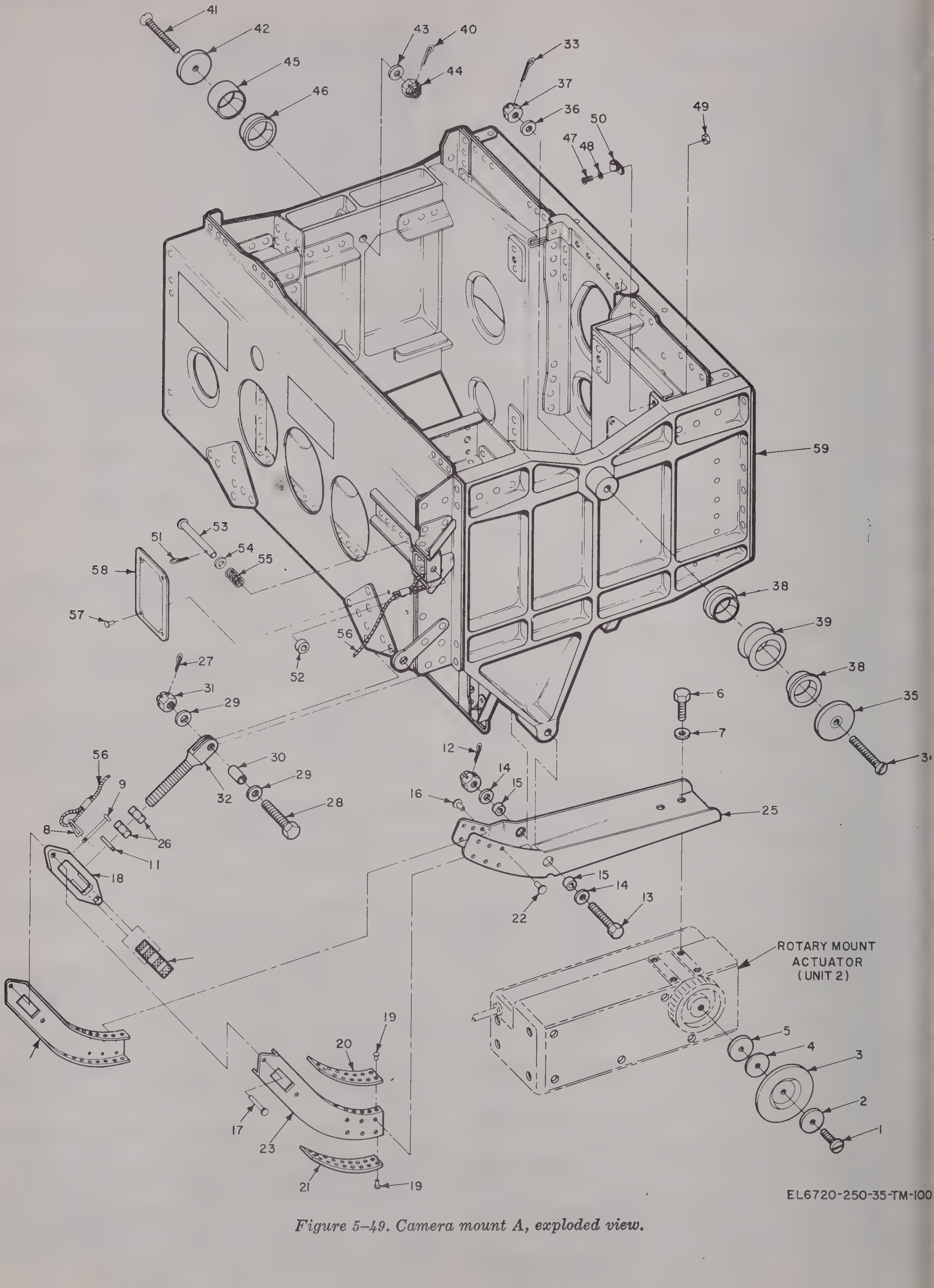


Figure 5-49. Camera mount A, exploded view.

1 Screw (1)
2 Bushing (1)
3 Follower (1)
4 Washer (1)
5 Washer (1)
6 Bolt (4)
7 Washer (4)
8 Pin (1)
9 Pin (1)
10 Knob (1)
11 Washer (1)
12 Pin (1)
13 Bolt (1)
14 Washer (2)
15 Spacer (2)
16 Nut (1)
17 Rivet (2)
18 Block (1)
19 Rivet (30)
20 Plate (1)
21 Plate (1)
22 Fastener (12)
23 Channel (1)
24 Channel (1)
25 Bracket (1)
26 Nut (2)
27 Pin (1)
28 Bolt (1)
29 Washer (2)
30 Spacer (1)
31 Nut (1)
32 Fork (1)
33 Pin (1)
34 Bolt (1)
35 Plate (1)
36 Washer (1)
37 Nut (1)
38 Bearing (2)
39 Bushing (1)
40 Pin (1)
41 Bolt (1)
42 Plate (1)
43 Washer (1)
44 Nut (1)
45 Bushing (1)
46 Bearing (1)
47 Screw (2)
48 Washer (2)
49 Nut (2)
50 Clamp (2)
51 Pin (1)
52 Spacer (1)
53 Pin (1)
54 Washer (1)
55 Spring (1)
56 Lanyard (1)
57 Rivet (4)
58 Nameplate (1)
59 Torque box assembly (1)

Figure 5-49—Continued.

(6) Remove six rivets (9) securing support (11) to cover (32).

Figure 5-50(1). Torque box assembly, exploded view (sheet 1 of 2).
[Located in back of manual]

Figure 5-50(2). Torque box assembly, exploded view (sheet 2 of 2).
[Located in back of manual]

(7) Remove rivet (10) securing support (11) to cover (32) and channel (46). Remove support (11) from cover (32) and channel (46).

(8) Remove six rivets (12) securing doubler (14) to cover (32) and zee (52).

(9) Remove two rivets (13) securing doubler (14) to cover (32), zee (52), and clip (54). Remove doubler (14) from cover (32), zee (52), and clip (54).

(10) Remove six rivets (12) securing doubler (15) to cover (32) and zee (52).

(11) Remove two rivets (13) securing doubler (15) to cover (32), zee (52), and clip (55). Remove doubler (15) from cover (32), zee (35), and clip (55).

(12) Remove four rivets (12) securing doubler (16) to cover (127) and channel (133).

(13) Remove two rivets (13) securing doubler (16) to cover (127) and channel (133).

(14) Remove two rivets (13) securing doubler (16) to cover (127), channel (133), and clip (200). Remove doubler (16) from cover (127), channel (133), and clip (200).

(15) Remove four rivets (12) securing doubler (17) to cover (127) and channel (133).

(16) Remove two rivets (13) securing doubler (17) to cover (127) and channel (136).

(17) Remove two rivets (13) securing doubler (17) to cover (127), channel (133), and clip (167). Remove doubler (17), from cover (127), channel (133), and clip (167).

(18) Remove two rivets (18) securing clip (19) to cover (24).

(19) Remove two rivets (18) securing clip (19) to cover (32). Remove clip (19) from cover (32).

(20) Remove seven rivets (20) securing cover (24) to cover (32).

(21) Remove rivet (21) securing cover (24) to cover (32) and channel (43).

(22) Remove rivet (22) securing cover (24) to cover (32) and zee (52).

(23) Remove two rivets (23) securing cover (24) to clip (49).

(24) Remove two rivets (23) securing cover (24) to angle (40).

(25) Remove 10 rivets (23) cover (24) to web (62), bracket (110), and clip (104).

(26) Remove 10 rivets (23) securing cover (24) to fitting (208).

(27) Remove three rivets (23) securing cover (24) to bracket (110).

(28) Remove three rivets (23) securing cover (24) to clip (104). Remove cover (24) from clip (104).

(29) Remove six rivets (25) securing cover (32) to cover (38).

(30) Remove two rivets (25) securing cover (32) to angle (120).

(31) Remove two rivets (25) securing cover (32) to channel (95).

(32) Remove four rivets (25) securing cover (32) to channel (46).

(33) Remove 12 rivets (25) securing cover (32) to zee (52).

(34) Remove five rivets (25) securing cover (32) to channel (47).

(35) Remove rivet (26) securing bracket (34) to cover (38) and cover (32).

(36) Remove rivet (26) securing bracket (35) to cover (38) and cover (32).

(37) Remove two rivets (27) securing cover (38) to cover (32) and bracket (82).

(38) Remove 19 rivets (27) securing cover (32) to web (62).

(39) Remove 21 rivets (28) securing cover (32) to channel (43).

(40) Remove two rivets (29) securing cover (32) to web (62) and hat (60). Remove cover (32) from web (62) and hat (60).

(41) Remove decal (30) and decal (31) from cover (32).

(42) Remove rivet (33) securing bracket (34) from cover (38).

(43) Remove rivet (33) securing bracket (35) to cover (38). Remove bracket (35) from cover (38).

(44) Remove rivet (36) securing cover (38) to angle (120).

(45) Remove nine rivets (36) securing cover (38) to web (62) and fitting (207). Remove cover (38) from web (62) and fitting (207).

(46) Remove two rivets (39) securing angle (40) to channel (43). Remove angle (40) from channel (43).

(47) Remove two rivets (41) securing channel (43) to angle (107).

(48) Remove two rivets (41) securing channel (43) to angle (89).

(49) Remove rivet (41) securing channel (43) to web (62) and bracket (67).

(50) Remove rivet (41) securing channel (43) to web (62) and bracket (65).

(51) Remove five rivets (41) securing channel (43) to web (62) and angle (109).

(52) Remove three rivets (41) securing channel (43) to web (62) and angle (88).

(53) Remove 10 rivets (41) securing channel (43) to web (62).

(54) Remove two rivets (42) securing channel (43) to web (62) and hat (60). Remove channel (43) from web (62) and hat (60).

(55) Remove two rivets (44) securing clip (45) to channel (46).

(56) Remove two rivets (44) securing clip (45) to zee (52) and bracket (86). Remove clip (45) from zee (52) and bracket (86).

(57) Remove two rivets (44) securing clip (45) to channel (47).

(58) Remove two rivets (44) securing clip (45) to zee (52) and bracket (105). Remove clip (45) from zee (52) and bracket (105).

(59) Remove two rivets (44) securing channel (46) to angle (89).

(60) Remove six rivets (44) securing channel (46) to web (62) and bracket (65). Remove channel (46) from web (62) and bracket (65).

(61) Remove two rivets (44) securing channel (47) to angle (107).

(62) Remove six rivets (44) securing channel (47) to web (62) and bracket (67). Remove channel (47) from web (62) and bracket (67).

(63) Remove two rivets (48) securing clip (49) to zee (52). Remove clip (49) from zee (52).

(64) Remove five rivets (50) securing zee (52) to web (62) and angle (103).

(65) Remove nine rivets (50) securing zee (52) to web (62).

(66) Remove two rivets (50) securing zee (52) to clip (54).

(67) Remove two rivets (50) securing zee (52) to clip (55).

(68) Remove two rivets (50) securing zee (52) to bracket (82).

(69) Remove three rivets (51) securing zee (52) to web (62) and angle (88). Remove zee (52) from web (62) and angle (88).

(70) Remove three rivets (53) securing clip (54) to panel (114) and bracket (105). Remove clip (54) from panel (114) and bracket (105).

(71) Remove three rivets (53) securing clip (55) to panel (99) and bracket (86). Remove clip (55) from panel (99) and bracket (86).

(72) Remove two rivets (56) securing doubler (57) and spacer (58) to hat (60). Remove doubler (57) and spacer (58) from hat (60).

(73) Remove four rivets (59) securing hat (60) to web (62). Remove hat (60) from web (62).

(74) Remove rivet (61) securing web (62) to bracket (65).

(75) Remove rivet (61) securing web (62) to bracket (67). Remove web (62) from bracket (67).

(76) Remove three rivets (63) securing bracket (65) to panel (99) and channel (95).

(77) Remove four rivets (63) securing bracket (65) to panel (99).

(78) Remove five rivets (64) securing bracket (65) to panel (99). Remove bracket (65) from panel (99).

(79) Remove six rivets (66) securing bracket (67) to panel (114) and bracket (112).

(80) Remove four rivets (66) securing bracket (67) to panel (114).

(81) Remove rivet (66) securing bracket (67) to panel (114) and angle (107).

(82) Remove rivet (66) securing bracket (67) to panel (114) and bracket (105). Remove bracket (67) from panel (114) and bracket (105).

(83) Remove four rivets (68) securing bracket (73) to panel (114).

(84) Remove two rivets (69) securing doubler (71) to panel (114), bracket (105), and bracket (73).

(85) Remove three rivets (69) securing doubler (81) to panel (114) and bracket (73).

(86) Remove rivet (70) securing doubler (71) to panel (114), bracket (105), and bracket (73). Remove doubler (71) from panel (114), bracket (105), and bracket (73).

(87) Remove two rivets (72) securing bracket (73) to clip (101). Remove bracket (73) from clip (101).

(88) Remove four rivets (74) securing bracket (19) to panel (99).

(89) Remove two rivets (75) securing doubler (77) to panel (99), bracket (86), and bracket (79).

(90) Remove three rivets (75) securing doubler (77) to panel (99) and bracket (79).

(91) Remove rivet (76) securing doubler (77) to panel (99), bracket (86), and bracket (79). Remove doubler (77) from panel (99), bracket (86), and bracket (79).

(92) Remove two rivets (78) securing bracket (79) to bracket (84). Remove bracket (79) from bracket (84).

(93) Remove four rivets (80) securing bracket (81) to bracket (86). Remove bracket (81) from bracket (86).

(94) Remove three rivets (80) securing bracket (82) to fitting (207).

(95) Remove three rivets (80) securing bracket (82) to bracket (86). Remove bracket (82) from bracket (86).

(96) Remove two rivets (83) securing bracket (84) to bracket (86). Remove bracket (84) from bracket (86).

(97) Remove rivet (85) securing bracket (86) to panel (99) and fitting (207).

(98) Remove three rivets (85) securing bracket (86) to panel (99). Remove bracket (86) from panel (99).

(99) Remove rivet (87) securing angle (88) to channel (95), bracket (91), and angle (89).

(100) Remove three rivets (87) securing angle (88) to bracket (91). Remove angle (88) from bracket (91).

(101) Remove three rivets (87) securing angle (89) to panel (99).

(102) Remove three rivets (87) securing angle (89) to bracket (91) and channel (95). Remove angle (89) from bracket (91) and channel (95).

(103) Remove four rivets (87) securing bracket (91) to fitting (207).

(104) Remove rivet (87) securing bracket (91) to fitting (207) and panel (99).

(105) Remove three rivets (87) securing bracket (91) to panel (99). Remove bracket (91) from panel (99).

(106) Remove decal (90) from bracket (91).

(107) Remove two rivets (92) securing doubler (93) to panel (99) and channel (95). Remove doubler (93) from panel (99) and channel (95).

(108) Remove four rivets (94) securing channel (95) to panel (99). Remove channel (95) from panel (99).

(109) Remove 11 rivets (96) securing panel (99) to fitting (207). Remove panel (99) from fitting (207).

(110) Remove decal (97) from panel (99).

(111) Remove decal (98) from panel (99).

(112) Remove two rivets (100) securing clip (101) to bracket (105). Remove clip (101) from bracket (105).

(113) Remove rivet (102) securing angle (103) to bracket (105) and clip (104).

(114) Remove rivet (102) securing angle (103) to bracket (103) to bracket (105) and angle (118).

(115) Remove four rivets securing angle (103) to bracket (105). Remove angle (103) from bracket (105).

(116) Remove three rivets (102) securing clip (104) to bracket (105). Remove clip (104) from bracket (105).

(117) Remove three rivets (102) securing angle (118) to bracket (105).

(118) Remove two rivets (102) securing bracket (105) to panel (114) and fitting (208).

(119) Remove four rivets (102) securing bracket (105) to panel (114). Remove bracket (105) from panel (114).

(120) Remove rivet (106) securing angle (109) to bracket (110) and angle (107).

(121) Remove rivet (106) securing angle (107) to bracket (110).

(122) Remove rivet (106) securing angle (107) to bracket (112) and panel (114). Remove angle (107) from bracket (112) and panel (114).

(123) Remove six rivets (108) securing angle (109) to bracket (110). Remove angle (109) from bracket (110).

(124) Remove three rivets (108) securing bracket (116) to bracket (110).

(125) Remove four rivets (108) securing bracket (110) to bracket (112).

(126) Remove two rivets (108) securing bracket (110) to bracket (112) and panel (114).

(127) Remove rivet (94) securing bracket (110) to bracket (112), panel (114), and fitting (208). Remove bracket (110) from bracket (112), panel (114), and fitting (208).

(128) Remove decal (90) from bracket (110).

(129) Remove 11 rivets (111) securing bracket (112) to panel (114) and fitting (208).

(130) Remove eight rivets (111) securing bracket (112) to panel (114). Remove bracket (112) from panel (114).

(131) Remove six rivets (113) securing panel (114) to fitting (208). Remove panel (114) from fitting (208).

(132) Remove decal (97) from panel (114).

(133) Remove decal (98) from panel (114).

(134) Remove three rivets (115) securing bracket (116) to fitting (208). Remove bracket (116) from fitting (208).

(135) Remove three rivets (117) securing angle (118) to fitting (208). Remove angle (118) from fitting (208).

(136) Remove four rivets (119) securing angle (120) to fitting (207). Remove angle (120) from fitting (207).

(137) Remove four rivets (121) securing two clips (123) to cover (127).

(138) Remove two rivets (122) securing clip (123) to cover (179). Remove clip (123) from cover (179).

(139) Remove two rivets (122) securing clip (123) to web (138) and fitting (207). Remove clip (123) from web (138) and fitting (207).

(140) Remove nine rivets (124) securing cover (127) to fitting (207).

(141) Remove rivet (124) securing cover (127) to web (138) and angle (180).

(142) Remove 14 rivets (124) securing cover (127) to web (138).

(143) Remove two rivets (125) securing cover (127) to clip (163).

(144) Remove two rivets (125) securing cover (127) to clip (195).

(145) Remove 12 rivets (125) securing cover (127) to channel (133).

(146) Remove six rivets (125) securing cover (127) to channel (136).

(147) Remove six rivets (125) securing cover (127) to channel (135).

(148) Remove eight rivets (125) securing cover (127) to cover (179).

(149) Remove rivet (126) securing cover (127) to cover (179) and channel (133). Remove cover (127) from cover (179) and channel (133).

(150) Remove two rivets (128) securing clip (130) to cover (179).

(151) Remove two rivets (128) securing clip (130) to fitting (207).

(152) Remove four rivets (129) securing two clips (130) to channel (133). Remove two clips (130) from channel (133).

(153) Remove two rivets (131) securing channel (133) to clip (167).

(154) Remove six rivets (131) securing channel (133) to web (138) and bracket (148).

(155) Remove rivet (131) securing channel (133) to web (138) and angle (165).

(156) Remove six rivets (131) securing channel (133) to web (138).

(157) Remove rivet (131) securing channel (133) to web (138) and angle (202).

(158) Remove eight rivets (131) securing channel (133) to zee (188).

(159) Remove rivet (131) securing channel (133) to web (138), angle (180), and zee (188).

(160) Remove two rivets (132) securing channel (133) to clip (200). Remove channel (133) from clip (200).

(161) Remove two rivets (134) securing channel (135) to clip (195).

(162) Remove two rivets (134) securing channel (135) to clip (185).

(163) Remove eight rivets (134) securing channel (135) to web (138) and angle (202). Remove channel (135) from web (138) and angle (202).

(164) Remove two rivets (134) securing channel (136) to clip (163).

(165) Remove two rivets (134) securing channel (136) to clip (153).

(166) Remove eight rivets (134) securing channel (136) to web (138) and angle (165). Remove channel (136) from web (138) and angle (165).

(167) Remove seven rivets (137) securing web (138) to fitting (207).

(168) Remove six rivets (137) securing web (138) to bracket (157).

(169) Remove eight rivets (137) securing web (138) to angle (180).

(170) Remove rivet (137) securing web (138) to angle (180) and zee (193).

(171) Remove eight rivets (137) securing web (138) to zee (193). Remove web (138) from zee (193).

(172) Remove two rivets (139) securing doubler (141) to doubler (169), bracket (151), and clip, (143).

(173) Remove three rivets (139) securing doubler (141) to doubler (169) and clip (143).

(174) Remove rivet (140) securing doubler (141) to doubler (169), bracket (150), and clip (143). Remove doubler (141) from doubler (169), bracket (150), and clip (143).

(175) Remove four rivets (139) securing clip (143) to doubler (169).

(176) Remove two rivets (142) securing clip (143) to clip (145). Remove clip (143) from clip (145).

(177) Remove rivet (144) securing clip (145) to bracket (148) and bracket (151).

(178) Remove rivet (144) securing clip (145) to bracket (151). Remove clip (145) from bracket (151).

(179) Remove rivet (146) securing bracket (148) to bracket (151) and clip (153).

(180) Remove rivet (146) securing bracket (151) to clip (153).

(181) Remove three rivets (147) securing bracket (148) to bracket (151).

(182) Remove rivet (147) securing bracket (148) to clip (149) and bracket (151). Remove bracket (148) from clip (149) and bracket (151).

(183) Remove rivet (147) securing clip (149) to bracket (151).

(184) Remove two rivets (147) securing clip (149) to fitting (207). Remove clip (149) from fitting (207).

(185) Remove rivet (150) securing bracket (151) to doubler (169) and angle (165).

(186) Remove five rivets (150) securing bracket (151) to doubler (169). Remove bracket (151) from doubler (169).

(187) Remove rivet (152) securing clip (153) to doubler (169) and angle (165).

(188) Remove rivet (152) securing clip (153) to doubler (169). Remove clip (153) from doubler (169).

(189) Remove rivet (154) securing clip (155), bracket (157) and bracket (161).

(190) Remove rivet (154) securing clip (155) to bracket (161).

(191) Remove two rivets (154) securing clip (155) to fitting (207). Remove clip (155) from fitting (207).

(192) Remove four rivets (154) securing bracket (157) to bracket (161).

(193) Remove rivet (156) securing bracket (157) to bracket (161). Remove bracket (157) from bracket (161).

(194) Remove three rivets (158) securing bracket (161) to doubler (169) and fitting (207).

(195) Remove 11 rivets (158) securing bracket (161) to doubler (169).

(196) Remove rivet (158) securing bracket (161) to doubler (169) and angle (165).

(197) Remove two rivets (159) securing doubler (160) and bracket (161) to doubler (169). Remove doubler (160) and bracket (161) from doubler (169).

(198) Remove decal (90) from bracket (161).

(199) Remove rivet (162) securing clip (163) to doubler (169) and angle (165).

(200) Remove rivet (162) securing clip (163) to doubler (169). Remove clip (163) from doubler (169).

(201) Remove six rivets (164) securing angle (165) to doubler (169). Remove angle (165) from doubler (169).

(202) Remove three rivets (166) securing clip (167) to doubler (169). Remove clip (167) from doubler (169).

(203) Remove six rivets (168) securing doubler (169) to fitting (207). Remove doubler (169) from fitting (207).

(204) Remove decal (97) from doubler (169).

(205) Remove decal (98) from doubler (169).

(206) Remove five rivets (170) securing doubler (172) to panel (204) and bracket (174).

(207) Remove rivet (171) securing doubler (172) to panel (204) and bracket (174). Remove doubler (172) from panel (204) and bracket (174).

(208) Remove four rivets (170) securing bracket (174) to panel (204).

(209) Remove two rivets (173) securing bracket (174) to clip (176). Remove bracket (174) from clip (176).

(210) Remove two rivets (175) securing clip (176) to zee (188). Remove clip (176) from zee (188).

(211) Remove rivet (177) securing cover (179) to angle (180) and clip (190).

(212) Remove rivet (177) securing cover (179) to clip (190).

(213) Remove two rivets (177) securing cover (179) to clip (182).

(214) Remove two rivets (177) securing cover (179) to angle (180).

(215) Remove ten rivets (177) securing cover (179) to fitting (208). Remove cover (179) from fitting (208).

(216) Remove six rivets (178) securing angle (180) to cover (179). Remove angle (180) from cover (179).

(217) Remove two rivets (181) securing clip (182) to zee (188). Remove clip (182) from zee (188).

(218) Remove two rivets (183) securing clip (185) to zee (188).

(219) Remove two rivets (184) securing clip (185) to panel (204). Remove clip (185) from panel (204).

(220) Remove 11 rivets (186) securing zee (188) to panel (204).

(221) Remove three rivets (187) securing zee (188) to angle (206). Remove zee (188) from angle (206).

(222) Remove two rivets (189) securing clip (190) to zee (193). Remove clip (190) from zee (193).

(223) Remove 11 rivets (191) securing zee (193) to panel (204).

(224) Remove three rivets (192) securing zee (193) to angle (206). Remove zee (193) from angle (206).

(225) Remove decal (90) from zee (193).

(226) Remove rivet (194) securing clip (195) to panel (204) and angle (202).

(227) Remove rivet (194) securing clip (195) to panel (204). Remove clip (195) from panel (204).

(228) Remove two rivets (196) securing doubler (197) and support (198) to panel (204). Remove doubler (197) and support (198) from panel (204).

(229) Remove three rivets (199) securing clip (200) to panel (204). Remove clip (200) from panel (204).

(230) Remove six rivets (201) securing angle (202) to panel (204). Remove angle (202) from panel (204).

(231) Remove 15 rivets (203) securing panel (204) to fitting (208). Remove panel (204) from fitting (208).

(232) Remove decal (97) from panel (204).

(233) Remove decal (98) from panel (204).

(234) Remove six rivets (205) securing two angles (206) to fitting (208). Remove two angles (206) from fitting (208).

b. Reassembly. To reassemble the torque box assembly, proceed as follows:

(1) Install two angles (206) to fitting (208), using six rivets (205).

(2) Install decal (97) and decal (98) on panel (204).

(3) Install panel (204) to fitting (208), using 15 rivets (203).

(4) Install angle (202) to panel (204), using six rivets (201).

(5) Install clip (200) to panel (204), using three rivets (199).

(6) Install doubler (197) and support (198) to panel (204), using two rivets (196).

(7) Install clip (195) to panel (204), using rivet (194).

(8) Install clip (195) to panel (204) and angle (202), using rivet (194).

(9) Install (90) to zee (193).

(10) Install zee (193) to angle (206), using three rivets (192).

(11) Install zee (193) to panel (204), using 11 rivets (191).

(12) Install clip (190) to zee (193), using two rivets (189).

(13) Install zee (188) to angle (206), using three rivets (187).

(14) Install zee (188) to panel (204), using 11 rivets (186).

(15) Install clip (185) to panel (204), using two rivets (184).

(16) Install clip (185) to zee (188), using two rivets (183).

(17) Install clip (182) to zee (188), using two rivets (181).

(18) Install angle (180) to cover (179), using six rivets (178).

(19) Install cover (179) to fitting (208), using 10 rivets (177).

(20) Install cover (179), to angle (180), using two rivets (177).

(21) Install cover (179) to clip (182), using two rivets (177).

(22) Install cover (179) to clip (190), using ivet (177).

(23) Install cover (179) to angle (180) and lip (190), using rivet (177).

(24) Install clip (176) to zee (188), using wo rivets (175).

(25) Install bracket (174) to clip (176), sing two rivets (173).

(26) Install bracket (174) to panel (204), sing four rivets (170).

(27) Install doubler (172) to panel (204) nd bracket (174), using rivet (171) and five ivets (170).

(28) Install decal (98) and decal (97) on oubler (169).

(29) Install doubler (169) to fitting (207), sing six rivets (168).

(30) Install clip (167) to doubler (169), sing three rivets (166).

(31) Install angle (165) to doubler (169), sing six rivets (164).

(32) Install clip (163) to doubler (169), sing rivet (162).

(33) Install clip (163) to doubler (169) and ngle (165), using rivet (162).

(34) Install decal (90) to bracket (161).

(35) Install doubler (160) and bracket (161) doubler (169), using two rivets (159).

(36) Install bracket (161) to doubler (169) nd angle (165), using rivet (158).

(37) Install bracket (161) to doubler (169), sing 11 rivets (158).

(38) Install bracket (161) to doubler (169) nd fitting (207), using three rivets (158).

(39) Install bracket (157) to bracket (161), sing rivet (156), and four rivets (154).

(40) Install clip (155) to fitting (207), using o rivets (154).

(41) Install clip (155) to bracket (161), ing rivet (154).

(42) Install clip (155) to bracket (157) and acket (161), using rivet (154).

(43) Install clip (153) to doubler (169), ing rivet (152).

(44) Install clip (153) to doubler (169) and gle (165), using rivet (152).

(45) Install bracket (151) to doubler (169), ing five rivets (150).

(46) Install bracket (151) to doubler (169) d angle (165).

(47) Install clip (149) to fitting (207), using o rivets (147).

(48) Install clip (149) to bracket (151), ing rivet (147).

(49) Install bracket (148) to clip (149) and bracket (151), using rivet (147).

(50) Install bracket (148) to bracket (151), using three rivets (147).

(51) Install bracket (151) to clip (153), using rivet (146).

(52) Install bracket (148) to bracket (151) and clip (153), using rivet (146).

(53) Install clip (145) to bracket (151), using rivet (144).

(54) Install clip (145) to bracket (148) and bracket (151), using rivet (144).

(55) Install clip (143) to clip (145), using two rivets (142).

(56) Install clip (143) to doubler (169), using four rivets (139).

(57) Install doubler (141) to doubler (169), bracket (151), and clip (143), using rivet (140).

(58) Install doubler (141) to doubler (169) and clip (143), using three rivets (139).

(59) Install doubler (141) to doubler (169), bracket (151), and clip (143), using two rivets (139).

(60) Install web (138) to zee (193), using eight rivets (137).

(61) Install web (138) to angle (180) and zee (193), using rivet (137).

(62) Install web (138) to angle (180), using eight rivets (137).

(63) Install web (138) to bracket (157), using six rivets (137).

(64) Install web (138) to fitting (207), using seven rivets (137).

(65) Install channel (136) to web (138) and angle (165), using eight rivets (134).

(66) Install channel (136) to clip (153), using two rivets (134).

(67) Install channel (136) to clip (163), using two rivets (134).

(68) Install channel (135) to web (138) and angle (202), using eight rivets (134).

(69) Install channel (135) to clip (185), using two rivets (134).

(70) Install channel (135) to clip (195), using two rivets (134).

(71) Install channel (133) to clip (200), using two rivets (132).

(72) Install channel (133) to web (138), angle (180), and zee (188), using rivet (131).

(73) Install channel (133) to zee (188), using eight rivets (131).

(74) Install channel (133) to web (138) and angle (202), using rivet (131).

(75) Install channel (133) to web (138), using six rivets (131).

(76) Install channel (133) to web (138) and angle (165), using rivet (131).

(77) Install channel (133) to web (138) and bracket (148), using six rivets (131).

(78) Install channel (133) to clip (167), using two rivets (131).

(79) Install two clips (130) to channel (133), using four rivets (129).

(80) Install clip (130) to fitting (207), using two rivets (128).

(81) Install clip (130) to cover (179), using two rivets (128).

(82) Install cover (127) to cover (179) and channel (133), using rivet (126).

(83) Install cover (127) to cover (179) using eight rivets (125).

(84) Install cover (127) to channel (135), using six rivets (125).

(85) Install cover (127) to channel (136), using rivets (125).

(86) Install cover (127) to channel (133), using 12 rivets (125).

(87) Install cover (127) to clip (195), using two rivets (125).

(88) Install cover (127) to clip (163), using two rivets (125).

(89) Install cover (127) to web (138), using 14 rivets (124).

(90) Install cover (127) to web (138) and angle (180), using rivet (124).

(91) Install cover (127) to fitting (207), using nine rivets (124).

(92) Install clip (123) to web (138) and fitting (207), using two rivets (122).

(93) Install clip (123) to cover (179), using two rivets (122).

(94) Install two clips (123) to cover (127), using four rivets (121).

(95) Install angle (120) to fitting (207), using four rivets (119).

(96) Install angle (118) to fitting (208), using three rivets (117).

(97) Install bracket (116) to fitting (208), using three rivets (115).

(98) Install decal (97) and decal (98) to panel (114).

(99) Install panel (114) to fitting (208), using six rivets (113).

(100) Install bracket (112) to panel (114), using eight rivets (111).

(101) Install bracket (112) to panel (114) and fitting (208), using 11 rivets (111).

(102) Install decal (90) to bracket (110).

(103) Install bracket (110) to bracket (112), panel (114), and fitting (208), using rivet (94).

(104) Install bracket (110) to bracket (112) and panel (114), using two rivets (108).

(105) Install bracket (110) to bracket (112), using four rivets (108).

(106) Install bracket (116) to bracket (110), using three rivets (108).

(107) Install angle (109) to bracket (110), using six rivets (108).

(108) Install angle (107) to bracket (112) and panel (114), using rivet (106).

(109) Install angle (107) to bracket (110), using rivet (106).

(110) Install angle (109) to bracket (110) and angle (107), using rivet (106).

(111) Install bracket (105) to panel (114), using four rivets (102).

(112) Install bracket (105) to panel (114) and fitting (208), using two rivets (102).

(113) Install bracket (105) to angle (118), using three rivets (102).

(114) Install clip (104) to bracket (105), using three rivets (102).

(115) Install angle (103) to bracket (105), using four rivets (102).

(116) Install angle (103) to bracket (105) and angle (118), using rivet (102).

(117) Install angle (103) to bracket (105) and clip (104), using rivet (102).

(118) Install clip (101) to bracket (105), using two rivets (100).

(119) Install decal (97) and decal (98) to panel (99).

(120) Install panel (99) to fitting (207), using 11 rivets (96).

(121) Install channel (95) to panel (99), using four rivets (94).

(122) Install doubler (93) to panel (99) and channel (95), using two rivets (92).

(123) Install decal (90) to bracket (91).

(124) Install bracket (91) to panel (99), using three rivets (87).

(125) Install bracket (91) to fitting (207) and panel (99), using rivet (87).

(126) Install bracket (91) to fitting (207), using four rivets (87).

(127) Install angle (89) to bracket (91) and channel (95), using three rivets (87).

(128) Install angle (89) to panel (99), using three rivets (87).

(129) Install angle (88) to bracket (91), using three rivets (87).

(130) Install angle (88) to channel (95), bracket (91), and angle (89), using rivet (87).

(131) Install bracket (86) to panel (99), using three rivets (85).

(132) Install bracket (86) to panel (99) and itting (207), using rivet (85).

(133) Install bracket (84) to bracket (86), sing two rivets (83).

(134) Install bracket (82) to bracket (86), sing three rivets (80).

(135) Install bracket (82) to fitting (207), sing three rivets (80).

(136) Install bracket (81) to bracket (86), sing four rivets (80).

(137) Install bracket (79) to bracket (84), sing two rivets (78).

(138) Install doubler (77) to panel (99), racket (86), and bracket (79), using rivet (76).

(139) Install doubler (77) to panel (99) and racket (79), using three rivets (75).

(140) Install doubler (77) to panel (99), racket (86), and bracket (79), using two rivets 75).

(141) Install bracket (79) to panel (99), sing four rivets (74).

(142) Install bracket (73) to clip (101), using wo rivets (72).

(143) Install doubler (71) to panel (114), racket (105), and bracket (73), using rivet (70).

(144) Install doubler (71) to panel (114) and racket (73), using three rivets (69).

(145) Install doubler (71) to panel (114) racket (105), and bracket (73), using two rivets 59).

(146) Install bracket (73) to panel (114), sing four rivets (68).

(147) Install bracket (67) to panel (114) and racket (105), using rivet (66).

(148) Install bracket (67) to panel (114) and ngle (107), using rivet (66).

(149) Install bracket (67) to panel (114), sing four rivets (66).

(150) Install bracket (67) to panel (114) and racket (112), using six rivets (66).

(151) Install bracket (65) to panel (99), ing five rivets (64).

(152) Install bracket (65) to panel (99), sing four rivets (63).

(153) Install bracket (65) to panel (99) and annel (95), using three rivets (63).

(154) Install web (62) to bracket (67), using vet (61).

(155) Install web (62) to bracket (65), using ivet (61).

(156) Install hat (60) to web (62), using four ivets (59).

(157) Install doubler (57) and spacer (58) to at (60), using two rivets (56).

(158) Install clip (55) to panel (99) and bracket (86), using three rivets (53).

(159) Install clip (54) to panel (114) and bracket (105), using three rivets (53).

(160) Install zee (52) to web (62) and angle (88), using three rivets (51).

(161) Install zee (52) to bracket (82), using two rivets (50).

(162) Install zee (52) to clip (55), using two rivets (50).

(163) Install zee (52) to clip (54), using two rivets (50).

(164) Install zee (52) to web (62), using nine rivets (50).

(165) Install zee (52) to web (62) and angle (103), using five rivets (50).

(166) Install clip (49) to zee (52), using two rivets (48).

(167) Install channel (47) to web (62) and bracket (67), using six rivets (44).

(168) Install channel (47) to angle (107), using two rivets (44).

(169) Install channel (46) to web (62) and bracket (65), using six rivets (44).

(170) Install channel (46) to angle (89), using two rivets (44).

(171) Install clip (45) to zee (52) and bracket (105), using two rivets (44).

(172) Install clip (45) to channel (47), using two rivets (44).

(173) Install clip (45) to zee (52) and bracket (86), using two rivets (44).

(174) Install clip (45) to channel (46), using two rivets (44).

(175) Install channel (43) to web (62) and hat (60), using two rivets (42).

(176) Install channel (43) to web (62), using 10 rivets (41).

(177) Install channel (43) to web (62) and angle (88), using three rivets (41).

(178) Install channel (43) to web (62) and angle (109), using five rivets (41).

(179) Install channel (43) to web (62) and bracket (65), using rivet (41).

(180) Install channel (43) to web (62) and bracket (67), using rivet (41).

(181) Install channel (43) to angle (89), using two rivets (41).

(182) Install channel (43) to angle (107), using two rivets (41).

(183) Install angle (40) to channel (43), using two rivets (39).

(184) Install cover (38) to web (62) and fitting (207), using nine rivets (37).

(185) Install cover (38) to angle (120), using rivet (36).

(186) Install bracket (35) to cover (38), using rivet (33).

(187) Install bracket (34) to cover (38), using rivet (33).

(188) Install decal (30) and decal (31) on cover (32).

(189) Install cover (32) to web (62) and hat (60), using two rivets (29).

(190) Install cover (32) to channel (43), using 21 rivets (28).

(191) Install cover (32) to web (62), using 19 rivets (27).

(192) Install cover (38) to cover (32) and bracket (82), using two rivets (27).

(193) Install bracket (35) to cover (38) and cover (32), using rivet (26).

(194) Install bracket (34) to cover (38) and cover (32), using rivet (26).

(195) Install cover (32) to channel (47), using five rivets (25).

(196) Install cover (32) to zee (52), using 12 rivets (25).

(197) Install cover (32) to channel (46), using four rivets (25).

(198) Install cover (32) to channel (95), using two rivets (25).

(199) Install cover (32) to angle (120), using two rivets (25).

(200) Install cover (32) to cover (38), using six rivets (25).

(201) Install cover (24) to clip (104), using three rivets (23).

(202) Install cover (24) to bracket (110), using three rivets (23).

(203) Install cover (24) to fitting (208), using 10 rivets (23).

(204) Install cover (24) to web (62), bracket (110), and clip (104), using 10 rivets (23).

(205) Install cover (24) to angle (40), using two rivets (23).

(206) Install cover (24) to clip (49), using two rivets (23).

(207) Install cover (24) to cover (32) and zee (52), using rivet (22).

(208) Install cover (24) to cover (32) and channel (43), using rivet (21).

(209) Install cover (24) to cover (32), using seven rivets (20).

(210) Install clip (19) to cover (32), using two rivets (18).

(211) Install clip (19) to cover (24), using two rivets (18).

(212) Install doubler (17) to cover (127), channel (133), and clip (167), using two rivets (13).

(213) Install doubler (17) to cover (127) and channel (136), using two rivets (13).

(214) Install doubler (17) to cover (127) and channel (133), using four rivets (12).

(215) Install doubler (16) to cover (127), channel (133), and clip (200), using two rivets (13).

(216) Install doubler (16) to cover (127) and channel (133), using two rivets (13).

(217) Install doubler (16) to cover (127) and channel (133), using four rivets (12).

(218) Install doubler (15) to cover (32), zee (52) and clip (55), using two rivets (13).

(219) Install doubler (15) to cover (32) and zee (52) using six rivets (12).

(220) Install doubler (14) to cover (32), zee (52) and clip (54), using two rivets (13).

(221) Install doubler (14) to cover (32) and zee (52), using six rivets (12).

(222) Install support (11) to cover (32) and channel (46), using rivet (10).

(223) Install support (11) to cover (32), using six rivets (9).

(224) Install support (8) to support (11), bracket (34), and bracket (35), using four rivets (7).

(225) Install bracket (6) to cover (38) and cover (32), using two rivets (5).

(226) Install bracket (4) to fitting (207), using two rivets (3).

(227) Install bracket (2) to angle (202) and angle (165), using eight rivets (124) and two rivets (1).

(228) Refer to paragraph 5–49*b* for further reassembly procedures.

5–51. Camera Mount B (Unit 12), Disassembly and Reassembly
(fig. 5–51)

a. Disassembly. To disassemble the camera mount B, proceed as follows:

(1) Remove screw (1), bushing (2), washer (4), and washer (5) securing follower (3) to rotary mount actuator pinion gear. Remove follower (3) from rotary mount actuator (Unit 2) pinion gear.

(2) Remove four bolts (6) and four washers (7) securing rotary mount actuator (Unit 2) to bracket (25). Remove rotary mount actuator (Unit 2) from bracket (25).

NOTE

For disassembly of rotary mount actuator (Unit 2), refer to paragraph 5-40*a*.

(3) Remove pin (8) from pin (9). Remove pin (9) from block (18).

(4) Remove knob (10) and washer (11) from fork (32) and block (18).

(5) Remove pin (12) from bolt (15).

(6) Remove nut (13), washer (14), two spacers (16), washer (14), and bolt (15) securing bracket (25) to mount assembly (50). Remove bracket (25) from mount assembly (50).

(7) Remove two rivets (17) securing block (18) to channel (23) and channel (24). Remove block (18) from channel (23) and channel (24).

(8) Remove 15 rivets (19) securing plate (20) to channel (23) and channel (24). Remove plate (20) from channel (23) and channel (24).

(9) Remove 15 rivets (19) securing plate (21) to channel (23) and channel (24). Remove plate (21) from channel (23) and channel (24).

(10) Remove six fasteners (22) securing channel (23) to bracket (25). Remove channel (23) from bracket (25).

(11) Remove six fasteners (22) securing channel (24) to bracket (25). Remove channel (24) from bracket (25).

(12) Remove two nuts (26) from fork (32).

(13) Remove pin (27) from bolt (31).

(14) Remove nut (28), washer (29), spacer (30), washer (29), and bolt (31) securing fork (32) to mount assembly (50). Remove fork (32) from mount assembly (50).

(15) Remove pin (33) from bolt (36).

(16) Remove nut (34), washer (35), and bolt (36) securing plate (37), bearing (38), bushing (39), and bearing (38) to mount assembly (50). Remove plate (37), bearing (38), bushing (39), and bearing (38) from mount assembly (50).

(17) Remove pin (40) from bolt (43).

(18) Remove nut (41), washer (42), and bolt (43) securing plate (44), bushing (45), and bearing (46) to mount assembly (50). Remove plate (44), bushing (45), and bearing (46) from mount assembly (50).

(19) Remove four rivets (47) securing nameplate (48) to mount assembly (50). Remove nameplate (48) from mount assembly (50).

(20) Uncrimp lanyard (49) and remove from mount assembly (50).

(21) For disassembly of mount assembly (50), refer to paragraph 5-52*a*.

b. Reassembly. To reassemble the camera mount B, proceed as follows:

(1) Perform paragraph 5-52*b* to insure that mount assembly (50) for the camera mount B is completely assembled.

(2) Crimp lanyard (49) to mount assembly (50).

(3) Install nameplate (48) to mount assembly (50), using four rivets (47).

(4) Install bearing (46), bushing (45), and plate (44) to mount assembly (50), using bolt (43), washer (42), and nut (41).

(5) Install pin (40) in bolt (43).

(6) Install bearing (38), bushing (39), bearing (38), and plate (37) to mount assembly (50), using bolt (36), washer (35), and nut (34).

(7) Install pin (33) in bolt (36).

(8) Install fork (32) in mount assembly (50), using bolt (31), washer (29), spacer (30), washer (29), and nut (28).

(9) Install pin (27) in bolt (31).

(10) Install two nuts (26) on fork (32).

(11) Install channel (24) to bracket (25), using six fasteners (22).

(12) Install channel (23) to bracket (25), using six fasteners (22).

(13) Install plate (21) to channel (23) and channel (24), using 15 rivets (19).

(14) Install plate (20) to channel (23) and channel (24), using 15 rivets (19).

(15) Install block (18) to channel (23) and channel (24), using two rivets (17).

(16) Install bracket (25) to mount assembly (50), using bolt (15), washer (14), two spacers (16), washer (14) and nut (13).

(17) Install pin (12) in bolt (15).

(18) Insert knob (10) in block (18) and install on fork (32), using washer (11).

(19) Adjust knob (10) as required. Tighten two nuts (26) on fork (32).

(20) Insert pin (9) in block (18).

(21) Install pin (8) in pin (9).

NOTE

Refer to paragraph 5-40*b* to insure that rotary mount actuator (Unit 2) is completely assembled.

(22) Install rotary mount actuator (Unit 2) to bracket (25), using four bolts (6) and four washers (7).

(23) Install follower (3) on rotary mount actuator (Unit 2) pinion gear, using washer (5), washer (4), bushing (2) and screw (1).

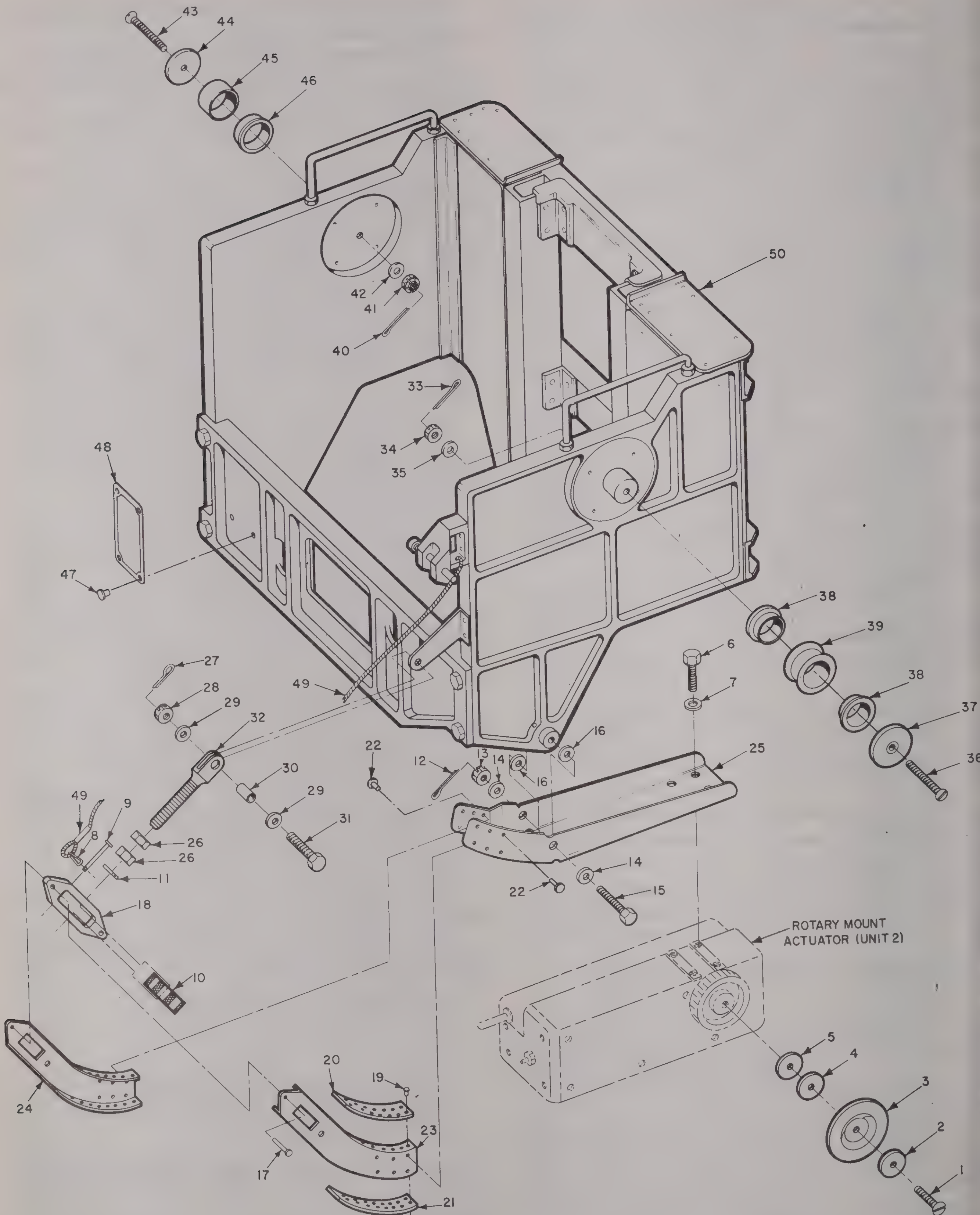


Figure 5-51. Camera mount B, exploded view.

1 Screw (1)
2 Bushing (1)
3 Follower (1)
4 Washer (1)
5 Washer (1)
6 Bolt (4)
7 Washer (4)
8 Pin (1)
9 Pin (1)
10 Knob (1)
11 Washer (1)
12 Pin (1)
13 Nut (1)
14 Washer (2)
15 Bolt (1)
16 Spacer (2)
17 Rivet (2)
18 Block (1)
19 Rivet (30)
20 Plate (1)
21 Plate (1)
22 Fastener (12)
23 Channel (7)
24 Channel (1)
25 Bracket (1)
26 Nut (2)
27 Pin (1)
28 Nut (1)
29 Washer (2)
30 Spacer (1)
31 Bolt (1)
32 Fork (1)
33 Pin (1)
34 Nut (1)
35 Washer (1)
36 Bolt (1)
37 Plate (1)
38 Bearing (2)
39 Bushing (1)
40 Pin (1)
41 Nut (1)
42 Washer (1)
43 Bolt (1)
44 Plate (1)
45 Bushing (1)
46 Bearing (1)
47 Rivet (4)
48 Nameplate (1)
49 Lanyard (1)
50 Mount assembly (1)

Figure 5-51—Continued.

5-52. Camera Mount B (Unit 12) Mount Assembly, Disassembly and Reassembly
(fig. 5-52 (1), (2), and (3))

a. Disassembly. To disassemble the mount assembly, proceed as follows:

(1) Perform paragraph 5-51*a*.

(2) Remove pin (1) from pin (2).

(3) Remove pin (2), spring (3), and spacer (4) from bracket (24).

(4) Remove four nuts (5) and eight washers (6) securing two handles (8) to fitting (41) and fitting (42). Remove two handles (8) from fitting (41) and fitting (42).

(5) Remove four nuts (7) from two handles (8).

(6) Remove four bolts (9) and four washers (10) securing fitting (16) to fitting (41) and fitting (42). Remove fitting (16) from fitting (41) and fitting (42).

(7) Remove decal (11) from fitting (16).

(8) Remove decal (12) from fitting (16).

(9) Remove six decals (13) from fitting (16), two webs (49), and channel (65).

(10) Remove six decals (14) from fitting (16), two webs (49), and channel (67).

(11) Remove six decals (15) from fitting (16), two webs (49), and channel (67).

(12) Remove rivet (17) securing spacer (18) to fitting (41). Remove spacer (18) from fitting (41).

(13) Remove two bolts (19) and two collars (20) securing bracket (21) to fitting (41). Remove bracket (21) from fitting (41).

(14) Remove two bolts (22) and two collars (23) securing bracket (24) to fitting (41). Remove bracket (24) from fitting (41).

(15) Remove four bolts (25) and four collars (26) securing trunnion (27) to fitting (41). Remove trunnion (27) from fitting (41).

(16) Remove four bolts (28) and four collars (29) securing trunnion (30) to fitting (42). Remove trunnion (30) from fitting (42).

(17) Remove eight rivets (31) and five rivets (32) securing plate (33) to channel (67), fitting (41), and channel (48). Remove plate (33) from channel (67), fitting (41), and channel (48).

(18) Remove eight rivets (31) and five rivets (32) securing plate (34) to channel (67), fitting (42), and channel (48). Remove plate (34) from channel (67), fitting (42), and channel (48).

(19) Remove two rivets (35) securing plate (58) to fitting (41).

(20) Remove two rivets (35) securing plate (59) to fitting (42).

(21) Remove two bolts (36) and two collars (37) securing fitting (41) to web (71) and channel (67).

(22) Remove two bolts (36) and two collars (37) securing fitting (41) to web (71) and channel (66).

(23) Remove two bolts (36) and two collars (37) securing fitting (42) to web (71) and channel (67).

(24) Remove two bolts (36) and two collars (37) securing fitting (42) to web (71) and channel (66).

(25) Remove eight rivets (38) securing four nut plates (39) to fitting (41). Remove four nut plates (39) from fitting (41).

(26) Remove eight rivets (38) securing four nut plates (39) to fitting (42). Remove four nut plates (39) from fitting (42).

(27) Remove 22 rivets (40) securing fitting (41) to two angles (44). Remove fitting (41) from two angles (44).

(28) Remove 22 rivets (40) securing fitting (42) to two angles (44). Remove fitting (42) from two angles (44).

(29) Remove four bolts (36) and four collars (37) securing two angles (44) to two webs (49) and two channels (48).

(30) Remove four bolts (36) and four collars (37) securing two angles (44) to two webs (71) and channel (67).

(31) Remove four bolts (36) and four collars (37) securing two angles (44) to two webs (71) and channel (66).

(32) Remove four bolts (36) and four collars (37) securing two angles (44) to two webs (49) and to two channels (57).

(33) Remove 14 rivets (43) securing two angles (44) to two webs (49). Remove two angles (44) from two webs (49).

(34) Remove four bolts (45) and four collars (46) securing two webs (49) to two channels (48) and two angles (74).

(35) Remove four bolts (45) and four collars (46) securing two webs (49) to two channels (57) and two angles (74).

(36) Remove four bolts (45) and four collars (46) securing two webs (49) to two channels (56).

(37) Remove six rivets (47) securing two webs (49) to two channels (56).

(38) Remove three rivets (47) securing web (49) to angle (76).

(39) Remove three rivets (47) securing web (49) to angle (77).

(40) Remove 14 rivets (47) securing two webs (49) to two angles (75).

(41) Remove 12 rivets (47) securing two webs (49) to two channels (57).

(42) Remove 12 rivets (47) securing two channels (48) to two webs (49). Remove two channels (48) from two webs (49).

(43) Remove four bolts (50) and four collars (51) securing channel (65) to two channels (56) and two webs (71).

(44) Remove six rivets (52) securing two channels (56) to two webs (71).

(45) Remove four rivets (52) securing two angles (54) to two channels (80).

(46) Remove two rivets (53) securing angle (55) to plate (58).

(47) Remove two rivets (53) securing angle (55) to plate (59).

(48) Remove four rivets (52) securing two angles (54) to two channels (56). Remove two angles (54).

(49) Remove four rivets (52) securing two angles (55) to two channels (56). Remove two angles (55) from two channels (56).

(50) Remove four rivets (53) securing channel (57) to plate (58). Remove channel (75) from plate (58).

(51) Remove four rivets (53) securing channel (57) to plate (59). Remove channel (57) from plate (59).

(52) Remove two rivets (53) securing plate (58) to channel (66).

(53) Remove two rivets (53) securing plate (59) to channel (66).

(54) Remove three rivets (53) securing angle (61) to plate (58). Remove plate (58) from angle (61).

(55) Remove three rivets (53) securing angle (61) to plate (59). Remove plate (59) from angle (61).

(56) Remove 14 rivets (60) securing two angles (44) to two webs (71). Remove two angles (44) from two webs (71).

(57) Remove six rivets (60) securing two angles (61) to two webs (71) and channel (66). Remove two angles (61) from two webs (71) and channel (66).

(58) Remove antichafe strip (62).

(59) Remove four bolts (63) and four collars (64) securing channel (65) to two angles (79). Remove channel (65).

(60) Remove four bolts (63) and four collars (64) securing channel (66) to two angles (79).

(61) Remove four bolts (63) and four collars (64) securing channel (67) to two angles (79).

(62) Remove six rivets (60) securing channel (66) to two webs (71).

(63) Remove 12 rivets (68) securing channel (67) to two webs (71).

(64) Remove eight bolts (69) and eight collars (70) securing two channels (66 and 67) to two angles (73) and two webs (71). Remove channels (66 and 67) from two webs (71).

(65) Remove 20 rivets (68) securing two webs (71) to two angles (73). Remove two webs (71).

(66) Remove 24 rivets (72) securing two angles (73) to two channels (80). Remove two angles (73) from two channels (80).

(67) Remove eight rivets (72) securing four angles (74) to two channels (80). Remove four angles (74) from two channels (80).

(68) Remove 14 rivets (72) securing two angles (75) to two channels (80). Remove two angles (75) from two channels (80).

(69) Remove three rivets (72) securing angle (76) to channel (80). Remove angle (76) from channel (80).

(70) Remove three rivets (72) securing angle (77) to channel (80). Remove angle (77) from channel (80).

(71) Remove 12 rivets (78) securing six angles (79) to two channels (80). Remove six angles (79) from two channels (80).

b. Reassembly. To reassemble the mount assembly, proceed as follows:

(1) Install six angles (79) to two channels (80), using 12 rivets (78).

(2) Install angle (77) to channel (80), using three rivets (72).

(3) Install angle (76) to channel (80), using three rivets (72).

(4) Install two angles (75) to two channels (80), using 14 rivets (72).

(5) Install four angles (74) to two channels (80), using eight rivets (72).

(6) Install two angles (73) to two channels (80), using 24 rivets (72).

(7) Install two webs (71) to two angles (73), using 20 rivets (68).

(8) Install channels (66 and 67) to two angles (73) and two webs (71), using eight collars (70) and eight bolts (69).

(9) Attach channel (67) and two webs (71), using 12 rivets (68).

(10) Attach channel (66) and two webs (71), using six rivets (60).

(11) Attach channel (67) to two angles (79), using four collars (64) and four bolts (63).

(12) Attach channel (66) to two angles (79), using four collars (64) and four bolts (63).

(13) Install channel (65) to two angles (79), using four collars (64) and four bolts (63).

(14) Install antichafe strip (62).

(15) Install two angles (61) to two webs (71) and channel (66), using six rivets (60).

(16) Install two angles (44) to two webs (71), using 14 rivets (60).

(17) Install plate (59) to angle (61), using three rivets (53).

(18) Install plate (58) to angle (61), using three rivets (53).

(19) Attach plate (59) to channel (66), using two rivets (53).

(20) Attach plate (58) to channel (66), using two rivets (53).

(21) Install channel (57) to plate (59), using four rivets (53).

(22) Install channel (57) to plate (58), using four rivets (53).

(23) Install two angles (55) to two channels (56), using four rivets (52).

(24) Install two angles (54) to two channels (56), using four rivets (52).

(25) Attach angle (55) to plate (59), using two rivets (53).

(26) Attach angle (55) to plate (58), using two rivets (53).

(27) Attach two angles (54) to two channels (80), using four rivets (52).

(28) Attach two channels (56) to two webs (71), using six rivets (52).

(29) Attach channel (65) to two webs (71) and two channels (56), using four collars (51) and four bolts (50).

(30) Install two channels (48) to two webs (49), using 12 rivets (47).

(31) Attach two webs (49) to two channels (57), using 12 rivets (47).

(32) Attach two webs (49) to two angles (75), using 14 rivets (47).

(33) Attach web (49) to angle (77), using three rivets (47).

(34) Attach web (49) to angle (76), using three rivets (47).

(35) Attach two webs (49) to two channels (56), using six rivets (47).

(36) Attach two webs (49) to two channels (56), using four collars (46) and four bolts (45).

(37) Attach two webs (49) to two angles (74) and two channels (57), using four collars (46) and four bolts (45).

(38) Attach two webs (49) to two angles (74) and two channels (48), using four collars (46) and four bolts (45).

(39) Install two angles (44) to two webs (49), using 14 rivets (43).

(40) Attach two angles (44) to two channels (57) and two webs (49), using four collars (37) and four bolts (36).

(41) Attach two angles (44) to two webs (71) and channel (66), using four collars (37) and four bolts (36).

(42) Attach two angles (44) to two webs (71) and channel (67), using four collars (37) and four bolts (36).

(43) Attach two angles (44) to two channels (48) and two webs (49), using four collars (37) and four bolts (36).

(44) Install fitting (42) to two angles (44), using 22 rivets (40).

(45) Install fitting (41) to two angles (44), using 22 rivets (40).

(46) Install four nutplates (39) to fitting (42), using eight rivets (38).

(47) Install four nutplates (39) to fitting (41), using eight rivets (38).

(48) Attach fitting (42) to channel (66) and web (71), using two collars (37) and two bolts (36).

(49) Attach fitting (42) to channel (67) and web (71), using two collars (37) and two bolts (36).

(50) Attach fitting (41) to channel (66) and web (71), using two collars (37) and two bolts (36).

(51) Attach fitting (41) to channel (67) and web (71), using two collars (37) and two bolts (36).

(52) Attach fitting (42) to plate (59), using two rivets (35).

(53) Attach fitting (41) to plate (58), using two rivets (35).

(54) Install plate (34) to channel (67), channel (48), and fitting (42), using five rivets (32) and eight rivets (31).

(55) Install plate (33) to channel (67), channel (48), and fitting (41), using five rivets (32) and eight rivets (31).

(56) Install trunnion (30) to fitting (42), using four collars (29) and four bolts (28).

(57) Install trunnion (27) to fitting (41), using four collars (26) and four bolts (25).

(58) Install bracket (24) to fitting (41), using two collars (23) and two bolts (22).

(59) Install bracket (21) to fitting (41), using two collars (20) and two bolts (19).

(60) Install spacer (18) to fitting (41), using rivet (17).

(61) Install six decals (15) on fitting (16), two webs (49), and channel (67).

(62) Install six decals (14) on fitting (16), two webs (49), and channel (65).

(63) Install six decals (13) on fitting (16), two webs (49), and channel (66).

(64) Install decal (12) on fitting (16).

(65) Install decal (11) on fitting (16).

(66) Install fitting (16) to fitting (42) and fitting (41), using four washers (10) and four bolts (9).

(67) Install four nuts (7) on two handles (8).

(68) Install two handles (8) to fitting (41) and fitting (42), using eight washers (6) and four nuts (5).

(69) Install pin (2), spring (3), and spacer (4) to bracket (24).

(70) Install pin (1) to pin (2).

(71) Refer to paragraph 5–51*b* for further assembly procedures.

5–53. Flight Line Tracker (Unit 13), Disassembly and Reassembly
(fig. 5–53)

a. Disassembly. To disassemble the flight line tracker, proceed as follows:

(1) Remove two nuts (1) and two washers (2) securing indicator (3) to channel assembly (8). Remove indicator (3) from channel assembly (8).

(2) Note location of washers (5), then drive out pin (4) from either side of pin (6) and remove associated washer (5).

(3) To separate channel assembly (8) from hinge (10), grasp end of pin (6) with remaining pin (4) and withdraw pin (6) from hinge (10), spring (7), and remaining washer (5). Note position of spring (7) for reassembling purposes.

NOTE

If pin (6) is to be replaced, drive out remaining pin (4).

(4) Remove two rivets (9) securing hinge (10) and block (11) to channel (14). Remove hinge (10) and block (11) from channel (14).

(5) Remove two rivets (12) securing hinge assembly (13) to channel (14). Remove hinge assembly (13) from channel (14).

b. Reassembly. To reassemble the flight line tracker, proceed as follows:

NOTE

Install two rivets (12) from bottom side of channel.

(1) Install hinge assembly (13) to top surface of channel (14), using two rivets (12).

(2) Align hinge (10) over block (11). Install block (11) and hinge (10) to top surface of channel (14), using two rivets (9).

(3) Install indicator (3) in channel assembly (8), then secure in place using one washer

(2) and one nut (1) at the top and bottom of the channel assembly.

(4) Position spring (7) to left of hinge (10), then position channel assembly (8) in front of the hinge and spring such that its bottom mounting holes align with similar holes in channel (14).

(5) Insert pin (6) through either side of channel assembly (8), hinge (10), spring (7), and the opposite side of the channel assembly (8).

(6) Install a washer (5) onto both protruding ends of pin (6), then secure pin (6) in place, using two pins (4).

5-54. Right Oblique Sight (Unit 14) or Left Oblique Sight (Unit 15), Disassembly and Reassembly
(fig. 5-54)

a. Disassembly. To disassemble the right oblique sight or left oblique sight, proceed as follows:

CAUTION

Use extreme care in (1) below to prevent damage to right or left mount assembly (3) and head (10).

(1) To remove right or left mount assembly (3) from head (10), remove screw (1) and washer (2) and carefully spread the separated ends of head (10) to permit removal of right or left mount assmbly (3).

NOTE

Cover the right or left mount assembly (3) with protective wrapping while it is removed from head (10) and lay on clean flat surface.

(2) To separate the pin and head assembly (7 through 10) from bracket (19), remove nut (4), two washers (5), and three washers (6).

NOTE

Hold the partially disassembled unit over some form of container when performing step (3) in case either ball (12) drops when bracket (19) is separated from head (10).

(3) Separate bracket (19) from head (10), note orientation of right or left disc (11), then remove disc from stud (8).

NOTE

Dowel pin (9) is held in place on head (10) by press-fit.

(4) Drive out roll pin (7) and unscrew stud (8) from head (10).

(5) Remove two screws (14), two washers (15), and two washers (16) securing nameplate (17) to head (10). Note orientation of nameplate (17) and remove from head (10).

(6) Remove two balls (12) and two springs (13) from bracket (19).

(7) Disassembly of the remaining parts is obvious from the exploded view (fig. 5-54) and upon inspection of the equipment.

b. Reassembly. To reassemble the right oblique sight and left oblique sight, proceed as follows:

(1) If existing drill hole in stud (8) cannot be reused, or if new stud is installed, drill a 0.0625-inch hole through stud (8), using the roll pin (7) mounting hole in head (10) as a guide.

(2) Screw stud (8) into head (10) as far as travel will permit.

(3) Secure stud (8), using press-fitting roll pin (7) through head (10) and into stud (8).

(4) Install nameplate (17) on head (10), using two washers (16), two washers (15), and two screws (14). Insure nameplate (17) is oriented properly for right or left oblique sight (*a*(5) above).

NOTE

Using Molycote, apply to portions of right or left disc (11) which comes in contact with ball (12).

(5) Replace right or left disc (11) on stud (8), insuring that disk is oriented properly (*a*(3) above).

NOTE

Using Molycote, lubricate two balls (12).

(6) Replace two springs (13) and two balls (12) in bracket (19).

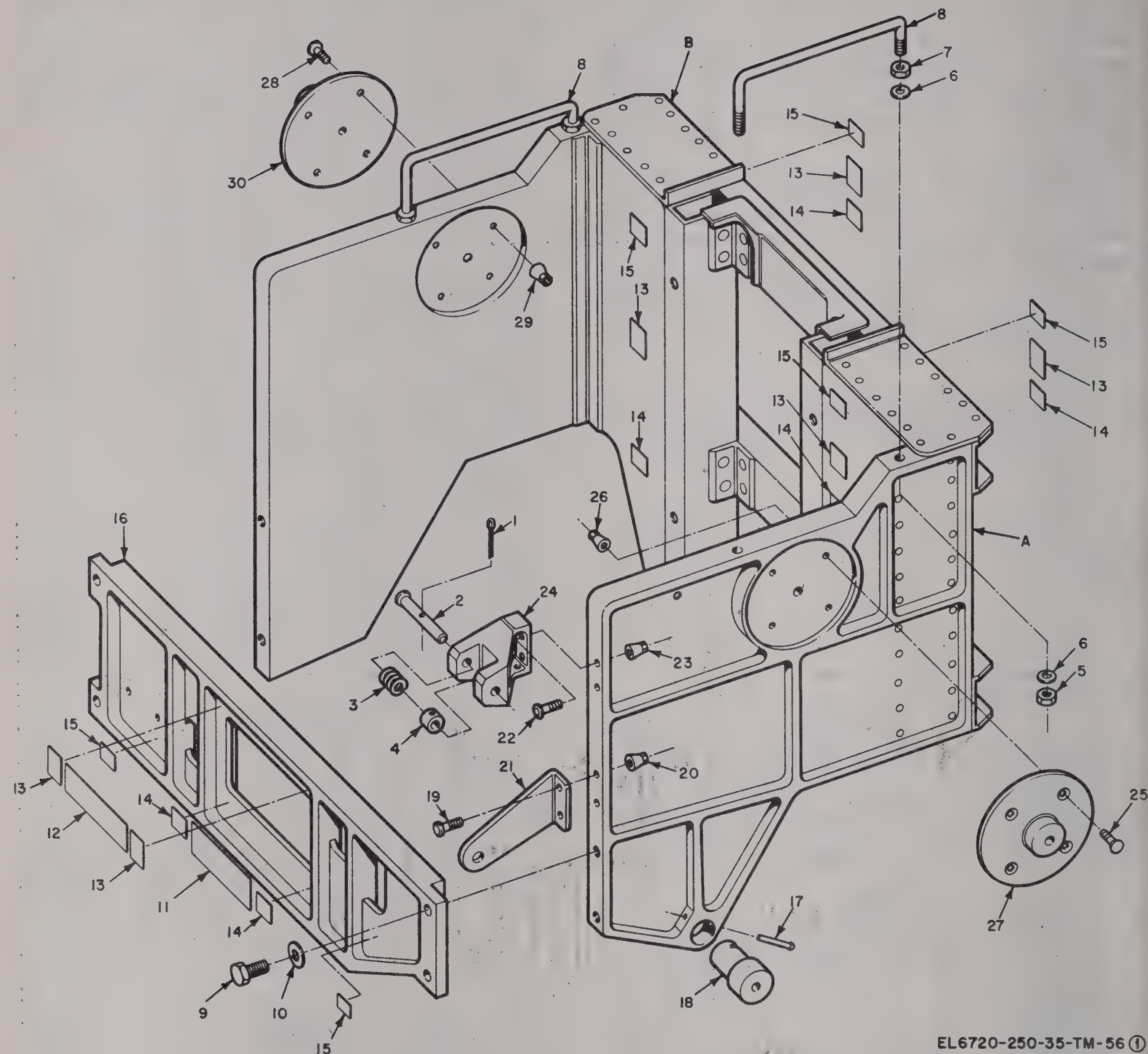
NOTE

Do not overtighten nut (4) so the indexing action of disc (11) is not impeded.

(7) Insert stud (8) of the pin and head assembly (7 through 10) through the mounting hole in bracket (19), then secure head (10) and bracket (19) together using washer (5), three washers (6), washer (5), and nut (4).

(8) Carefully spread the separated ends of head (10), then install the right or left mount assembly (3) into head (10).

(9) Insure the right or left mount assembly (3) is seated properly in the contoured track of



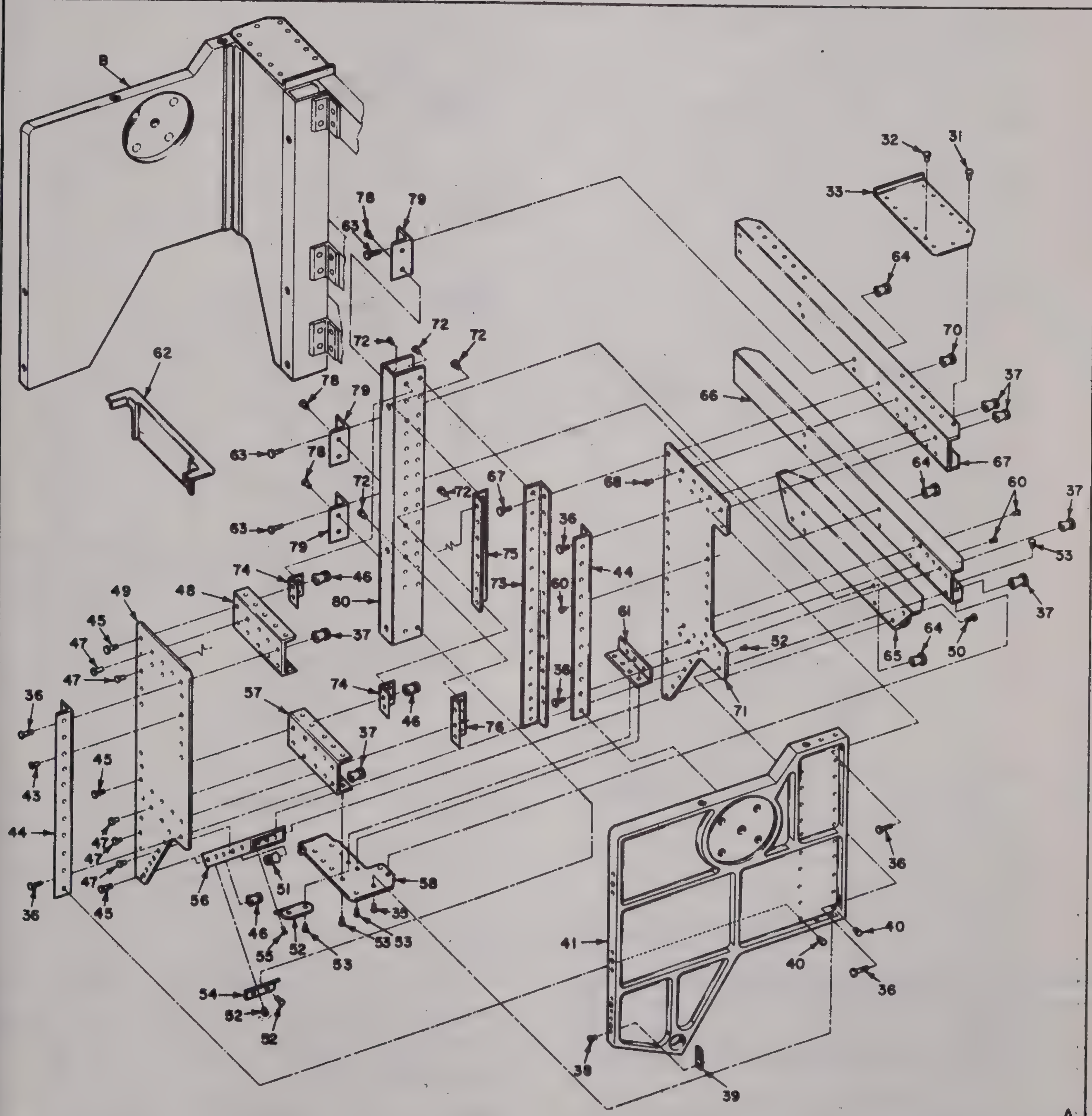
EL6720-250-35-TM-56 ①

1 Pin (1)
2 Pin (1)
3 Spring (1)
4 Spacer (1)
5 Nut (4)
6 Washer (8)
7 Nut (4)
8 Handle (2)
9 Bolt (4)
10 Washer (4)
11 Decal (1)
12 Decal (1)
13 Decal (6)
14 Decal (6)
15 Decal (6)
16 Fitting (1)
17 Rivet (1)
18 Spacer (1)
19 Bolt (2)
20 Collar (2)
21 Bracket (1)
22 Bolt (2)
23 Collar (2)
24 Bracket (1)
25 Bolt (4)
26 Collar (4)
27 Trunnion (1)
28 Bolt (4)
29 Collar (4)
30 Trunnion (1)
31 Rivet (16)
32 Rivet (10)
33 Plate (1)
34 Plate (1)
35 Rivet (4)
36 Bolt (24)
37 Collar (24)
38 Rivet (16)
39 Nut plate (8)
40 Rivet (44)
41 Fitting (1)
42 Fitting (1)
43 Rivet (14)
44 Angle (4)
45 Bolt (12)
46 Collar (12)
47 Rivet (50)
48 Channel (2)
49 Web (2)
50 Bolt (4)
51 Collar (4)

Figure 5-52(1). Mount assembly, exploded view (part 1 of 3).

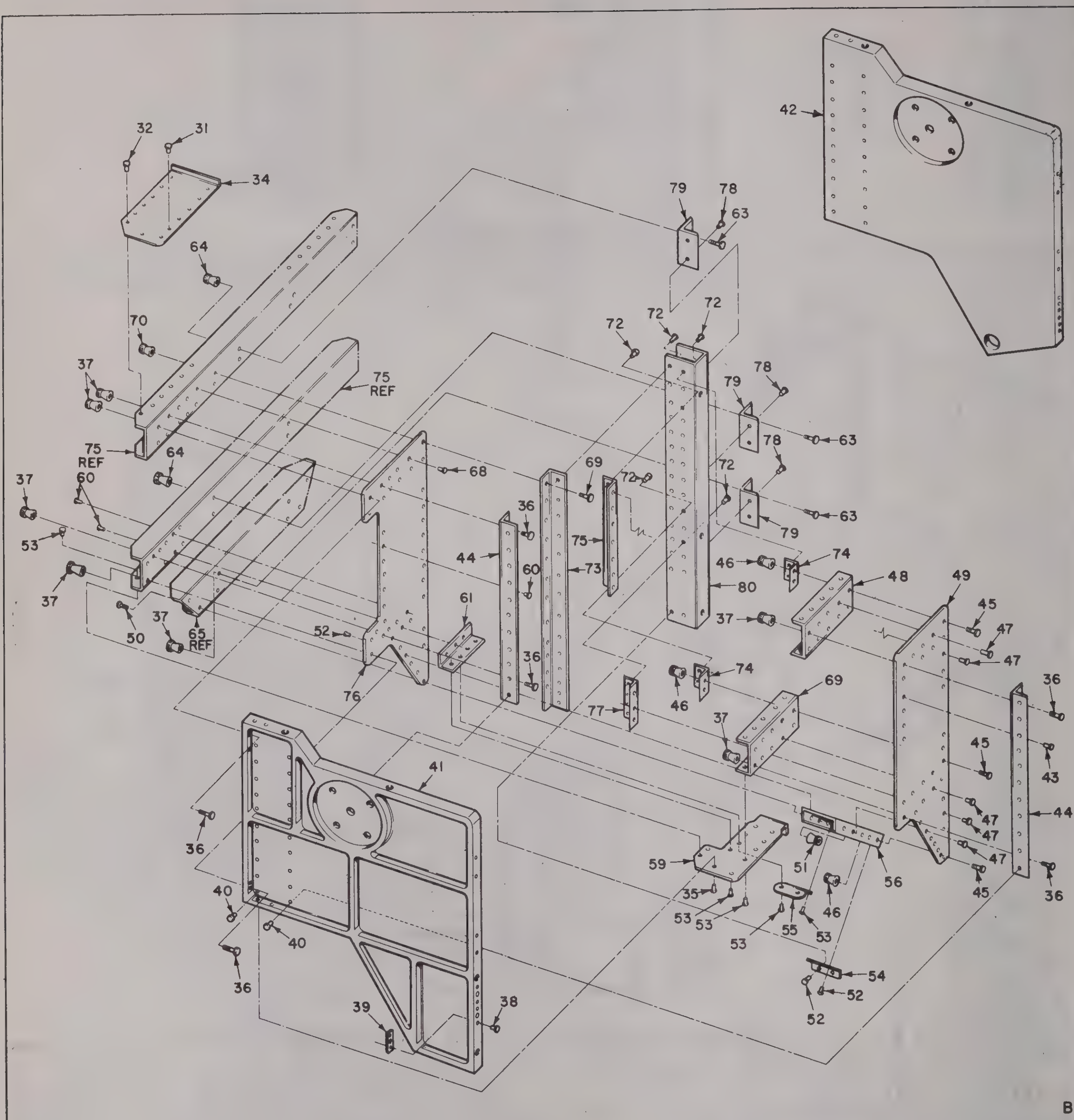
52 Rivet (18)
53 Rivet (22)
54 Angle (2)
55 Angle (2)
56 Channel (2)
57 Channel (2)
58 Plate (1)
59 Plate (1)
60 Rivet (26)
61 Angle (2)
62 Antichafe strife (1)
63 Bolt (12)
64 Collar (12)
65 Channel (1)
66 Channel (1)
67 Channel (1)
68 Rivet (32)
69 Bolt (8)
70 Collar (8)
71 Web (2)
72 Rivet (52)
73 Angle (2)
74 Angle (4)
75 Angle (2)
76 Angle (1)
77 Angle (1)
78 Rivet (12)
79 Angle (6)
80 Channel (2)

Figure 5-52(1)—Continued.



EL6720-250-35-TM-56 ②

Figure 5-52(2). Mount assembly, exploded view (part 2 of 3).



EL6720-250-35-TM-56(3)

Figure 5–52(3). Mount assembly, exploded view (part 3 of 3).

head (10), then secure the separated ends of head (10) together using washer (2) and screw (1).

(10) When reassembly is complete, rotate head (10) to its three depression angle positions to insure it indexes properly.

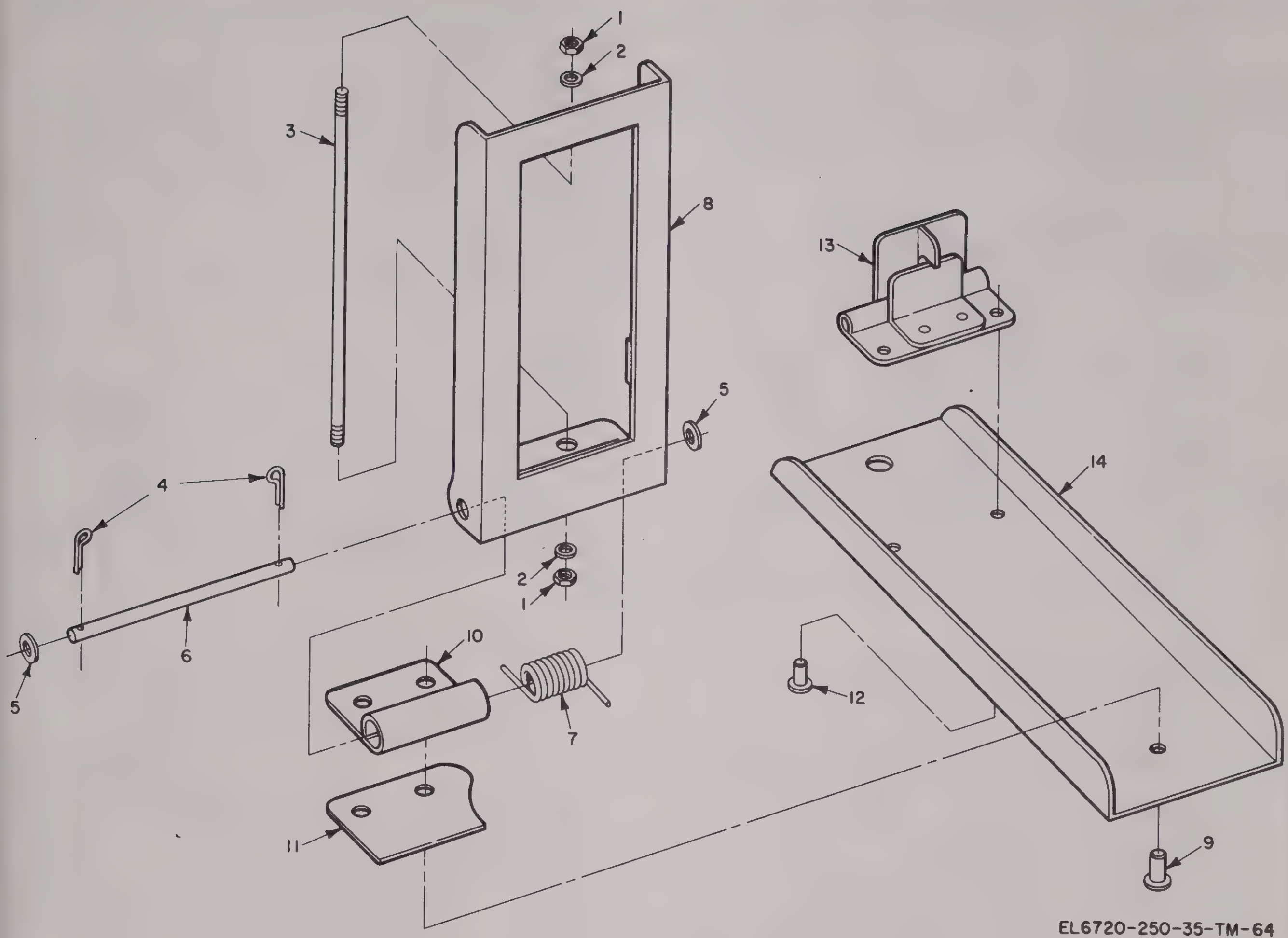
5–55. Adjustments

The major components requiring adjustments are given below.

a. Manual V/H Control Panel (Unit 7) Adjustments. The manual V/H control panel (Unit 7) after repair and reassembly requires the following adjustments:

NOTE

Access to adjustments in manual V/H control panel is gained by removing the top cover.



1	Nut (2)	8	Channel assembly (1)
2	Washer (2)	9	Rivet (2)
3	Indicator (1)	10	Hinge (1)
4	Pin (2)	11	Block (1)
5	Washer (2)	12	Rivet (2)
6	Pin (1)	13	Hinge assembly (1)
7	Spring (1)	14	Channel (1)

Figure 5-53. Flight line tracker, exploded view.

(1) Connect test setup as shown in figure 5-3 in accordance with procedures in paragraph 5-5*a*, (1) through (7).

(2) Set POWER switch 7S1 on manual V/H control panel to ON position.

(3) Allow 15 minutes for warmup.

(4) Connect digital voltmeter ME-218/GSM-64 to terminals D (-) and E (+) on test cable terminal board TB1.

(5) Set VELOCITY-KNOTS thumbwheels on manual V/H control panel to 200.

(6) Set ALTITUDE-FEET thumbwheels on manual V/H control panel to 00100.

(7) Adjust potentiometer 7A5A3R2 (fig. 5-34) in manual V/H control panel until digital voltmeter indicates from +100.58 to +100.62 volts dc.

(8) Set VELOCITY-KNOTS thumbwheels on manual V/H control panel to 300.

(9) Set ALTITUDE-FEET thumbwheels on manual V/H control panel to 45000.

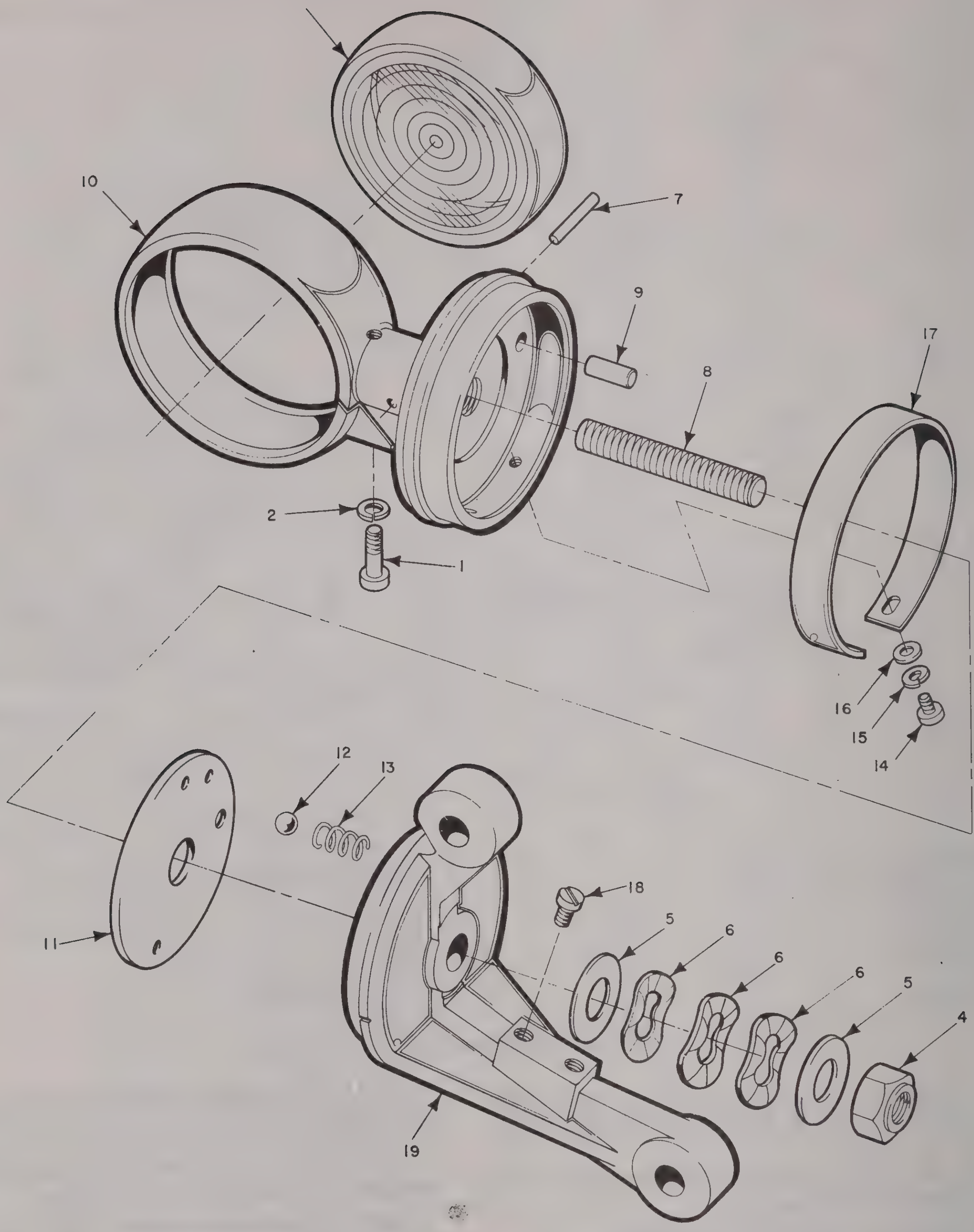
(10) Adjust potentiometer 7R1 (fig. 3-3) in manual V/H control panel until digital voltmeter indicates from +0.353 to +0.357 volt dc.

(11) Repeat procedures in (5) through (10) above as required to eliminate interaction between adjustments.

(12) Turn all power off and disconnect test setup.

b. Photo System Assembly (Unit 1) Adjustments.

(1) *Intervalometer module 1A1, adjustment of variable resistor 1A1A1R9.* To properly adjust



1 Screw (1)
2 Washer (1)
3 Mount assembly, right or left (1)
4 Nut (1)
5 Washer (2)
6 Washer (3)
7 Roll pin (1)
8 Stud (1)
9 Dowel pin (1)
10 Head (1)
11 Disc, right or left (1)
12 Ball (2)
13 Spring (2)
14 Screw (2)
15 Washer (2)
16 Washer (2)
17 Nameplate (1)
18 Screw (2)
19 Bracket (1)

Figure 5-54. Right oblique sight or left oblique sight, exploded view.

intervalometer module variable resistor 1A1A1-R9, proceed as follows:

(*a*) Insert intervalometer module 1A1 into INTERVALOMETER connector J2 of module test adapter (part of LS-80A).

(*b*) Connect clip (adjacent to TP1 connector) on module test adapter to junction of 1A1C2 and 1A1CR4 on intervalometer module 1A1.

(*c*) Connect vtvm to DC VOLTS INPUT and GRD terminals (MASTER section) on LS-80A.

NOTE

It is not necessary to connect the R C bridge, digital timer and oscilloscope to perform this adjustment procedure.

(*d*) Connect module test adapter, test equipment and LS-80A as shown in test setup (fig. 5-14).

NOTE

Refer to figure 5-13 for location of controls and indicators on LS-80A.

(*e*) Set switches and controls on LS-80A as follows:

1. MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

2. POWER switch (PANEL POWER section) to ON. Allow 15 minutes for warmup.

3. All other switches and controls to their OFF, neutral or counterclockwise positions.

(*f*) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to INTVL R9 BAL position.

NOTE

Adjust variable resistor 1A1A1R9 until vtvm indicates as close to zero volt dc as possible.

(*g*) Adjust variable resistor 1A1A1R9 (fig. 5-38) until vtvm indicates from -1 to +1 volt dc.

(2) *Intervalometer module 1A1, adjustment of variable resistor 1A1A1R7.* To properly adjust intervalometer module variable resistor 1A1A1-R7, proceed as follows:

(*a*) Perform (1) (*a*) through (*e*) above.

(*b*) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to INTVL R7 BAL position.

NOTE

Adjust variable resistor until vtvm indicates as close to zero volt dc as possible.

(*c*) Adjust variable resistor 1A1A1R7 (fig. 5-38) until vtvm indicates from -1 to +1 volt dc.

(3) *Film drive amplifier module 1A2 variable resistor 1A2R13 adjustment.* To properly adjust variable resistor 1A2R13, proceed as follows:

(*a*) Insert film drive amplifier module 1A2 into FILM DRIVE AMPLIFIER connector J3 of module test adapter (part of LS-80A).

NOTE

It is not necessary to connect the R C bridge, oscilloscope and digital timer to perform this adjustment procedure.

(*b*) Connect vtvm to DC VOLTS INPUT and GRD terminals (MASTER section) on LS-80A.

(*c*) Connect module test adapter, vtvm and LS-80A as shown in figure 5-14.

NOTE

Refer to figure 5-13 for location of controls and indicators on LS-80A.

(*d*) Set switches and controls on LS-80A as follows:

1. MASTER switch (MASTER section) to CONTROL PWR SUPPLY position.

2. POWER switch (PANEL POWER section) to ON position.

3. All other switches and controls to their OFF, neutral or counterclockwise positions.

(*e*) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to FDA R13 ADJ position.

(*f*) Adjust module variable resistor 1A2-R13 (fig. 5-39) for minimum indication (0 to 5 volts dc) on vtvm.

(4) *Film drive amplifier module 1A2 variable resistor 1A2R9 adjustment.* To properly adjust variable resistor 1A2R9, proceed as directed.

(*a*) Perform (3) (*a*) through (*d*) above.

(*b*) Set MODULE TEST switch (CONTROL-POWER SUPPLY section) on LS-80A to FDA R9 ADJ position.

(*c*) Adjust variable resistor 1A2R9 (fig. 5-39) for minimum indication (0 to 5 volts dc) on vtvm.

c. Rotary Mount Actuator (Unit 2) Adjustments.

(1) *Variable resistor 2R6 adjustment.* To properly adjust variable resistor 2R6, proceed as follows:

(*a*) Make certain variable resistor 2R3 has been properly indexed.

(*b*) Physically position camera to 90° depression point and insert index pin as prescribed in airframe manufacturer's manual. Witness mark rotary mount actuator and aircraft frame to indicate camera 90° depression point. Remove indexing pin.

(*c*) Perform operational check of paragraph 5-14*a* (1) through (11).

(*d*) Set switch S2 on test cable to position 2.

(*e*) Observe witness marks ((*b*) above) and note their relative positions.

(*f*) If witness marks are not aligned with each other, very slowly rotate variable resistor 2R6 (fig. 5-23) until camera is positioned such that witness mark alignment results.

(*g*) Set switches S1 and S2 on test cable to their off positions.

(*h*) Disconnect test setup.

(2) *Variable resistor 2A1R25 adjustment.* To properly adjust variable resistor 2A1R25, proceed as follows:

(*a*) Using a jumper test lead, connect the base lead of transistor 2A1Q9 to terminal 2A-1E3.

NOTE

Do not connect switch S2 on test cable (fig. 5-20) during this adjustment procedure.

(*b*) Perform operational check of paragraph 5-14*a* (1) through (11).

(*c*) Adjust variable resistor 2A1R25 (fig. 5-24) to its maximum counterclockwise position.

(*d*) Using the multimeter on 10 vdc range, connect leads between terminal 7 (+) of differential comparator assembly 2A1AR3 and terminal 2A1E3 (-).

(*e*) Connect a continuously adjustable 0- to 5-volt dc power source between terminal 2A-1E3 (+) and terminal 2A1E10 (-) on rotary mount actuator.

(*f*) Set 0- to 5-volt dc power source controls to produce __________volts dc output. The multimeter should indicate +3.2 volts dc.

(*g*) Slowly rotate variable resistor 2A1R-25 in a clockwise direction until multimeter indicates -0.5 volt dc.

(*h*) Set switch S1 on test cable to off position.

(*i*) Disconnect test setup.

(3) *Variable resistor 2A1R42 adjustment.* To properly adjust variable resistor 2A1R42, proceed as follows:

(*a*) Using a jumper test lead, connect base lead of transistor 2A1Q7 to terminal 2A-1E3.

NOTE

Do not connect switch S2 on test cable (fig. 5-20) during this adjustment procedure.

(*b*) Perform operational check of paragraph 5-14*a* (1) through (11).

(*c*) Adjust variable resistor 2A1R42 (fig. 5-24) to its maximum counterclockwise position.

(*d*) Using the multimeter on 10 vdc range, connect leads between terminal 7 (+) of differential comparator assembly 2A1R4 and terminal 2A1E3 (-).

(*e*) Connect a continuously adjustable zero to five volts dc power source between terminal 2A1E3 (+) and terminal 2A1E10 (-) on rotary mount actuator.

(*f*) Set 0- to 5-volt dc power source controls to produce__________volts dc output. The multimeter should indicate +3.2 volts dc.

(*g*) Slowly rotate variable resistor 2A1R-42 in clockwise direction until multimeter indicates -0.5 volt dc.

(*h*) Set switch S1 on test cable to off position.

(*i*) Disconnect test setup.

d. Door Actuator (Unit 4) Adjustments. Adjustments of the door actuator are made after an operational check has been performed and the actuator shaft extension and/or retraction lengths have been found to be out-of-tolerance. Perform the operational check (para 5-15*a*) and proceed as follows:

(1) *Retract actuator shaft.* If actuator shaft is fully retracted, but not within tolerance, adjust limit switch retract adjustment (fig. 5-55) from 13.71 to 13.79 inches.

(2) *Limit switch.* If actuator shaft is fully retracted and within tolerance, but retract lamp DS2 on test cable (fig. 5-25) does not light, adjust light switch retract adjustment (fig. 5-55) until retract lamp DS2 on test cable (fig. 5-25) lights (0.05 ± 0.02 inch before full retraction).

(3) *Extend actuator shaft.* If actuator shaft is fully extended, but not within tolerance, adjust limit switch extend adjustment (fig. 5-55) to bring actuator shaft from 19.65 to 19.73 inches.

NOTE

The extend limit light switch is not used in the camera control system, therefore the following adjustment is included for reference purposes only.

(4) *Extend limit light switch.* If actuator shaft is fully extended and within tolerance, but extend lamp DS1 on test cable (fig. 5–25) does not light, adjust light switch extend adjustment (fig. 5–55) until extend lamp DS1 on test cable (fig. 5–25) lights (0.05 ± 0.02 inch before full extension).

e. Light Sensor (Unit 5). The light sensor is calibrated by inserting setscrews (18, fig. 5–48) in aperture plate (23) to control the amount of light which can be detected by the photocell (15). To accomplish this, proceed as follows:

(1) Disassemble the light sensor for access to aperture plate (23) as directed in paragraph 5–45*a*.

(2) Remove or insert setscrews (18) on the outside limits of the aperture plate (23) to correspondingly increase or decrease the light level output of the photocell (15). Whichever step is taken is dependent upon the outcome of the light sensor operational check (para 5–16*a*).

(3) Repeat (2) above as often as necessary to comply with the test requirements of paragraph 5–16*a*.

(4) Reassemble the light sensor as directed in applicable steps of paragraph 5–45*b*.

f. Pod Assembly (Unit 10). Refer to TM 11–6760–228–35–1 for general support adjustments on pod assembly.

g. Camera (Unit 9). Refer to TM 11–6720–236–35 for general support adjustments on camera.

5–56. Alignment

The only major component requiring alignment is the flight line tracker (Unit 13). After the flight line tracker is repaired or replaced, a vertical alignment check must be performed in accordance with the directions given in TM 11–1510–204–20–2/1.

5–57. Epoxy Coating

After any maintenance has been performed that requires removal of the surface coating on printed circuit board modules, the exposed areas must be recoated for fungus and moisture protection using the following procedure:

WARNING

Xylol is toxic and flammable, use it only in small quantities in a well ventilated area. Do not breathe vapors or allow liquid to contact the skin. Do not use in the presence of open flame or sparks.

a. Part A (resin). Measure 100 parts by weight of Araldite 571 CX (manufactured by Ciba Co., Fair Lawn, N.J.) with 29 parts by weight of Beetle 216–8 (manufactured by American Cyanamid

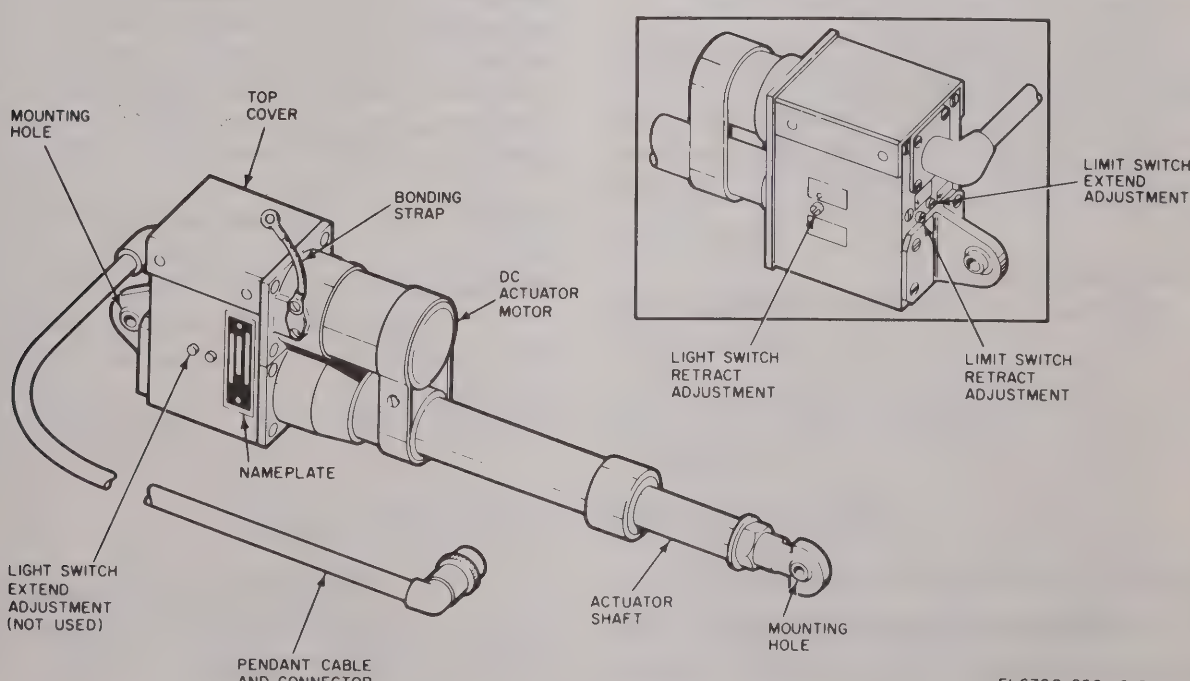


Figure 5–55. Door actuator, location of adjustments.

Co.) and stir well. Mix 27 parts by weight of Xylol (Federal Specification TT-X-916) and stir well. Mix 13 parts by weight of Diacetone Alcohol (Federal Specification O-D-306) and stir well. Store in separate container.

b. Part B (hardener). Measure 100 parts by weight of Araldite 820 (manufactured by Ciba Co., Fair Lawn, N.J.) with 37.5 parts by weight of Xylol (Federal Specification TT-X-916) and stir well. Mix 20 parts by weight of Butyl Alcohol (Federal Specification TT-B-846) and stir well. Store in separate container.

c. To prepare epoxy for immediate use—prepare the epoxy for immediate use, mix two parts "A" (resin) with one part "B" (hardener) in a quantity that can be used in 8 hours. Mix thoroughly. Brush the mixture onto the areas to be coated making sure to avoid areas that require mechanical movement, such as control adjustments and wafer switch contacts.

d. The epoxy mixture will dry to the touch in approximately 1 hour when applied in a film of 0.005 to 0.010 inch thickness. Total curing time requires 24 hours at room temperature. Curing time can be shortened by heating in a circulating oven at 150°F for 3 hours.

CHAPTER 6

GENERAL SUPPORT TESTING PROCEDURES

Section I. GENERAL

6-1. General

a. Testing procedures are prepared for use by Signal field maintenance shops and Signal service organizations responsible for general support maintenance of electronic equipment to determine the acceptability of repaired electronic equipment. These procedures set forth specific requirements that repaired electronic equipment must meet before it is returned to the using organization.

b. The testing procedures for major components and their modules within the capabilities of the general support maintenance repairman are listed below together with references to their respective paragraphs or applicable technical manuals.

(1) *Manual V/H control panel (Unit 7).* (Paras 6-4 and 6-5).

(2) *Photo junction panel (Unit 8).* The testing procedures to be performed by general support maintenance are identical with the testing procedures performed by direct support maintenance (paras 4-6 and 4-7).

(3) *Photo control panel (Unit 3).* (Paras 6-6 and 6-7).

(4) *Photo system assembly (Unit 1).* (Paras 6-8 and 6-9).

(5) *Rotary mount actuator (Unit 2).* (Paras 6-10 and 6-11).

(6) *Door actuator (Unit 4).* (Paras 6-12 and 6-13).

(7) *Light sensor (Unit 5).* Paras 6-14 and 6-15).

(8) *Camera pulse panel (134AV81400-1 or 134AV81400-3) (Unit 6).* The testing procedures to be performed by general support maintenance are identical with the testing procedures performed by direct support maintenance (paras 4-12 and 4-13).

(9) *Pod assembly (Unit 10).* Refer to TM 11-6760-228-35-1 for testing procedures on pod assembly.

(10) *Camera (Unit 9).* Refer to TM 11-6720-236-35 for testing procedures on camera.

(11) *Camera mount A (Unit 11) or camera mount B (Unit 12).* (Paras 6-16 and 6-17).

(12) *Flight line tracker (Unit 13).* Para 6-18).

(13) *Right oblique sight (Unit 14) and left oblique sight (Unit 15).* (Para 6-19).

c. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each step of each test procedure in sequence. For each step, perform all the actions required in the *Test equipment* and *Equipment under test* columns; then perform each specific test procedure and verify it against its performance standard.

6-2. Special Requirements

Not applicable.

6-3. Modification Work Orders

Not applicable.

Section II. MANUAL V/H CONTROL PANEL (UNIT 7)

6-4. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Took Kit, Photograph Repair TK-77/GF.

(2) Took Kit, Photograph Repair TK-109/GF.

b. Test Connections and Conditions. The physical tests and inspections are performed with the manual V/H control panel disconnected from all external circuits.

c. Procedure.

Step No.	Control settings			Test procedure	Performance standard
		Test Equipment	Equipment under test		
1	NA		MANUAL V/H CONTROL PANEL: Controls may be in any position.	*a.* Inspect all controls and mechanical assemblies for loose or missing screws, washers, and nuts.	*a.* Screws, washers, and nuts must be tight; none missing.
				b. Inspect all connectors and sockets, and receptacles, including the fuse holder, for looseness and damage.	*b.* No looseness or damage is evident.
				c. Inspect chassis for missing screws, fittings, and nuts. Inspect the condition of the finish and panel lettering.	*c.* Screws, fittings, and nuts must be tight; none missing. External surfaces intended to be painted must be painted and panel lettering must be legible.
				Note. Touchup painting is recommended in lieu of refinishing whenever practicable. Screwheads, binding posts, receptacles, and plated fasteners parts will be painted or polished with abrasive.	
				d. Inspect all numerals on VELOCITY-KNOTS and ALTITUDE-FEET thumbwheels.	*d.* Numerals must be clear and legible.
2	NA		MANUAL V/H CONTROL PANEL: Controls may be in any position.	*a.* Set POWER switch to ON and OFF positions.	*a.* Operates freely in both positions.
				b. Set OVERRIDE switch to MANUAL and AUTO positions.	*b.* Operates freely in both positions.
				c. Depress PRESS TO RESET switch and then release.	*c.* Switch depresses and releases freely.
				d. Depress AUTO FAIL TEST pushbutton switch and then release.	*d.* Switch depresses and releases freely.
				e. Rotate the three VELOCITY-KNOTS thumbwheels through all positions.	*e.* Thumbwheels rotate freely between detented positions. All detents function normally.
				f. Rotate the five ALTITUDE-FEET thumbwheels through all positions.	*f.* Thumbwheels rotate freely between detented positions. All detents function normally.

6-5. Electrical Test

a. Test Equipment and Materials.

(1) *Test equipment.*

(*a*) Ac voltmeter ME-119/NPM-38.

(*b*) Power source, +24 to +28.5 volts dc.

(*c*) Power source, 108 to 118 volts ac, single phase, 400Hz.

(*d*) Digital Voltmeter ME-231/FYQ-5.

(*e*) Dc multifunction plug-in unit, model 3444A (28480).

(*f*) Digital Voltmeter ME-218/GSM-64.

(2) *Materials.*

(*a*) Switch MS25103-24.

(*b*) Switch MS35058-22 (3 required).

(*c*) Terminal board MS27212-1-20.

(*d*) Terminal board, MIL-T-55164/14, type 8TB6.

(*e*) Connector MS3126F-14-19S.

(*f*) Resistor RW24V100 (10 ohms, ± 10%, 91W).

(*g*) Resistor RN75B110F (1,100 ohms ± 10%, 1W) (5 required).

(*h*) Transformer P/N 1HMQ07UK (584-74).

(*i*) Zener diode 1N1600.

(*j*) Wiring, No. 18AWG (as required).

b. Test Connections and Conditions.

WARNING

Make sure that 115-volt ac, 400-Hz and +28-volt dc power sources are off before performing steps (1) through (6) below. Dangerous voltages of 115 volts ac, 400 Hz, and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate test cable as shown in figure 5-3.

(2) Connect the connector P1 on test cable (fig. 5-3) to connector 7J1 on manual V/H control panel.

(3) Set switches on manual V/H control panel as follows:

(*a*) POWER switch to OFF position.

(*b*) OVERRIDE switch to MANUAL position.

(*c*) VELOCITY-KNOTS thumbwheels to 050.

(*d*) ALTITUDE-FEET thumbwheels to 00050.

(4) Set switches S1, S2, S3, and S4 on test cable to their off positions.

(5) Remove top cover from manual V/H control panel.

(6) Connect test cable (fig. 5-3) to 115-volt ac, 400-Hz and +28-volt dc power sources.

(7) Turn ac and dc power sources on.

(8) Set switches S1 and S4 on test cable to on position. Allow 15 minutes for warm up.

(9) Adjust transformer T1 on test cable until a voltmeter indicates 115 ± 5 volts ac.

c. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	NA	NA	Observe the two front panel edge lamps, three VELOCITY-KNOTS lamps, and five ALTITUDE-FEET lamps.	All lamps are lit.
2	NA	MANUAL V/H CONTROL PANEL: Power switch: ON	Observe AUTO FAIL indicator on manual V/H control panel.	The AUTO FAIL indicator is off.
3	TEST CABLE: Switch S2: on	NA	Observe AUTO FAIL indicator on manual V/H control panel for action and brightness.	The AUTO FAIL indicator is flashing at a rate from 5 to 15 flashes per 10 seconds.
4	NA	MANUAL V/H CONTROL PANEL: PRESS TO RESET switch: momentarily depressed and then released.	Observe AUTO FAIL indicator on manual V/H control panel for action and brightness.	The AUTO FAIL indicator is constantly lit at a reduced brightness as compared to brightness observed in step 3.
5	TEST CABLE: Switch S2: off	NA	Observe AUTO FAIL indicator on manual V/H control panel.	The AUTO FAIL indicator goes out.
6	TEST CABLE: Switch S4: off	NA	Observe AUTO FAIL indicator on manual V/H control panel for action and brightness.	The AUTO FAIL indicator is flashing at a rate from 5 to 15 flashes per 10 seconds.
7	NA	MANUAL V/H CONTROL PANEL: PRESS TO RESET switch; momentarily depressed and then released.	Observe AUTO FAIL indicator on manual V/H control panel for action and brightness.	The AUTO FAIL indicator remains constantly lit at a reduced brightness as compared to brightness observed in step 6.
8	TEST CABLE. Switch S2: on	NA	Observe AUTO FAIL indicator on manual V/H control panel for action and brightness.	The AUTO FAIL indicator remains constantly lit and the brightness does not change as compared to brightness in step 7.
9	TEST CABLE: Switch S2: on	NA	Observe AUTO FAIL indicator on manual V/H control panel for brightness.	The AUTO FAIL indicator remains constantly lit and the brightness is reduced as compared to brightness in step 8.
10	TEST CABLE: Switch S2: off Switch S3: off Switch S4: on	NA	Observe AUTO FAIL indicator on manual V/H control panel.	The AUTO FAIL indicator goes out.
11	NA	MANUAL V/H CONTROL PANEL: AUTO FAIL TEST pushbutton switch: depress and hold.	Observe AUTO FAIL indicator on manual V/H control panel for action.	The AUTO FAIL indicator is flashing at a rate from 5 to 15 flashes per 10 seconds.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
12	NA	MANUAL V/H CONTROL PANEL: AUTO FAIL TEST pushbutton switch: release switch.	Observe AUTO FAIL indicator on manual V/H control panel.	The AUTO FAIL indicator goes out.
			Note. In the following steps, (13 through 16), Digital Voltmeter ME-231/FYQ-5 with dc multifunction plug-in unit is used to measure dc voltages.	
13	NA	NA	Using digital voltmeter, connect leads between terminals M (+) and P (–) of TB1 on test cable and observe indication.	The digital voltmeter indicates 0.0 volt dc.
14	NA	MANUAL V/H CONTROL PANEL: OVERRIDE switch: AUTO	Observe digital voltmeter indication	The digital voltmeter indicates from +26.5 to +29.5 volts dc.
15	NA	MANUAL V/H CONTROL PANEL: OVERRIDE switch: MANUAL	Using digital voltmeter, connect leads between test jack 7TP8 (–) and 7A1TP7 (+) on manual V/H control panel and observe indication.	The digital voltmeter indicates from –4 to –6 volts dc.
16	NA	NA	Using digital voltmeter, connect leads between test jacks 7TP9 (+) and 7A1TP7 (–) on manual V/H control panel and observe indication.	The digital voltmeter indicates from +123 to +133 volts dc.
			Note. In the following steps (17, 19, and 21), Digital Voltmeter ME-218/GSM-64 is used to measure dc voltages.	
17	NA	*a.* MANUAL V/H CONTROL PANEL: NA	Using digital voltmeter, connect leads between terminals E (+) and D (–) of TB1 on test cable.	*a.* The digital voltmeter indicates from +49.294 to +51.306 volts dc.
		b. VELOCITY-KNOTS thumbwheels: 070 ALTITUDE-FEET thumbwheels: 02000		*b.* The digital voltmeter indicates from +1.725 to +1.795 volt dc.
		c. VELOCITY-KNOTS thumbwheels: 100 ALTITUDE-FEET thumbwheels: 00050		*c.* The digital voltmeter indicates from +98.588 to +102.612 volts dc.
		d. VELOCITY-KNOTS thumbwheels: 150 ALTITUDE-FEET thumbwheels: 05000		*d.* The digital voltmeter indicates from +1.478 to +1.539 volt dc.
		e. VELOCITY-KNOTS thumbwheels: 180 ALTITUDE-FEET thumbwheels: 07500		*e.* The digital voltmeter indicates from +1.183 to +1.231 volt dc.
		f. ALTITUDE-FEET thumbwheels: 15000		*f.* The digital voltmeter indicates from +0.591 to +0.615 volt dc.
		g. VELOCITY-KNOTS thumbwheels: 195 ALTITUDE-FEET thumbwheels: 00100		*g.* The digital voltmeter indicates from +96.123 to +100.046 volts dc.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
		h. VELOCITY-KNOTS thumbwheels: 200 ALTITUDE-FEET thumbwheels: 00500		*h.* The digital voltmeter indicates from +19.717 to +20.522 volts dc.
		i. ALTITUDE-FEET thumbwheels: 00950		*i.* The digital voltmeter indicates from +10.377 to +10.801 volts dc.
		j. ALTITUDE-FEET thumbwheels: 02000		*j.* The digital voltmeter indicates from +4.929 to +5.130 volts dc.
		k. ALTITUDE-FEET thumbwheels: 06000		*k.* The digital voltmeter indicates from +1.643 to +1.710 volt dc.
		l. VELOCITY-KNOTS thumbwheels: 220 ALTITUDE-FEET thumbwheels: 04550		*l.* The digital voltmeter indicates from +2.383 to +2.480 volts dc.
		m. VELOCITY-KNOTS thumbwheels: 235 ALTITUDE-FEET thumbwheels: 08550		*m.* The digital voltmeter indicates from +1.354 to 1.410 volt dc.
		n. VELOCITY-KNOTS thumbwheels: 250 ALTITUDE-FEET thumbwheels: 15000		*n.* The digital voltmeter indicates from +0.821 to +0.855 volt dc.
		o. ALTITUDE-FEET thumbwheels: 20000		*o.* The digital voltmeter indicates from +0.616 to +.641 volt dc.
		p. VELOCITY-KNOTS thumbwheels: 300 ALTITUDE-FEET thumbwheels: 00150		*p.* The digital voltmeter indicates from +98.588 to +102.612 volts dc.
		q. ALTITUDE-FEET thumbwheels: 20000		*q.* The digital voltmeter indicates from +0.739 to +0.769 volt dc.
		r. VELOCITY-KNOTS thumbwheels: 400 ALTITUDE-FEET thumbwheels: 10000		*r.* The digital voltmeter indicates from +1.971 to +2.052 volts dc.
		s. VELOCITY-KNOTS thumbwheels: 450 ALTITUDE-FEET thumbwheels: 12550		*s.* The digital voltmeter indicates from +1.767 to +1.839 volt dc.
		t. VELOCITY-KNOTS thumbwheels: 499 ALTITUDE-FEET thumbwheels: 49990		*t.* The digital voltmeter indicates from +0.491 to +0.512 volt dc.
18	NA	NA	Adjust transformer T1 on test cable until ac voltmeter indicates 121 ± 5 volts ac.	NA

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
19	NA	*a.* MANUAL V/H CONTROL PANEL: VELOCITY-KNOTS thumbwheels: 050 ALTITUDE-FEET thumbwheels: 00050		*a.* The digital voltmeter indicates from +49.294 to +51.306 volts dc.
		b. VELOCITY-KNOTS thumbwheels: 100		*b.* The digital voltmeter indicates from 98.588 to +102.612 volts dc.
		c. VELOCITY-KNOTS thumbwheels: 499 ALTITUDE-FEET thumbwheels: 49990		*c.* The digital voltmeter indicates from +0.491 to +0.512 volt dc.
20	NA	NA	Adjust transformer T1 on test cable until ac voltmeter indicates 108 ± 5 volts ac.	NA
21	NA	*a.* MANUAL V/H CONTROL PANEL: VELOCITY-KNOTS thumbwheels: 050 ALTITUDE-FEET thumbwheels: 00050		*a.* The digital voltmeter indicates from +49.294 to +51.306 volts dc.
		b. VELOCITY-KNOTS thumbwheels: 100		*b.* The digital voltmeter indicates from +98.588 to +102.612 volts dc.
		c. VELOCITY-KNOTS thumbwheels: 499 ALTITUDE-FEET thumbwheels: 49990		*c.* The digital voltmeter indicates from +0.491 to +0.512 volt dc.
22	TEST CABLE: Switch S1: off Switch S4: off	MANUAL V/H CONTROL PANEL: POWER switch: OFF	Disconnect test setup	NA

Section III. PHOTO CONTROL PANEL (Unit 3)

6-6. Physical Tests and Inspection

a. Test Equipment and Materials. None required.

b. Test Connections and Conditions. Remove cover from photo control panel.

c. *Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	NA	PHOTO CONTROL PANEL: Controls may be in any position.	*a.* Inspect selector switches for loose or missing setscrews and nuts. *b.* Inspect cover and panel lettering for damage and condition of finish. *c.* Inspect connector and lamp holders for looseness and damage.	*a.* Setscrews and nuts must be tight, none missing. *b.* Cover must not show any evidence of damage and all lettering must be clear and legible. *c.* No looseness or damage evident.
2	NA	PHOTO CONTROL PANEL: Controls may be in any position.	*a.* Set FRAMES REMAINING counter reset knob for proper resetting of counter mechanism. *b.* Rotate SYS PWR switch in all its positions. *c.* Place V/H switch to AUTO and MANUAL positions.	*a.* Reset knob must be firm and turn without evidence of binding. *b.* Switch must not be loose or remain stuck when transferring from positions. *c.* Operates freely to both positions.

6-7. Electrical Test

a. Test Equipment and Materials.

(1) Test set, control panel, focal plane shutter LS-78A

(2) Voltmeter ME-202A/U

(3) Power source, 108 to 118 volts ac, single phase, 400 Hz.

(4) Power source, +24 to +28.5 volts dc.

b. Test Connections and Conditions.

(1) Set all switches and controls on LS-78A to their OFF, neutral or counterclockwise position.

(2) Connect test cable W1 of LS-78A to +28-volt dc and 115-volt ac, 400-Hz power sources; and POWER connector J2.

(3) Perform initial test equipment calibration (*c* below).

(4) Connect the equipment as shown in figure 5-10.

(5) Set switches on photo control panel as follows:

(*a*) MODE switch to AUTO position.

(*b*) V/H switch to AUTO position.

(*c*) MOUNT switch to 90° position.

(*d*) SYS PWR switch to OFF position.

(*e*) FRAMES REMAINING counter to 100.

c. Initial Test Equipment Calibration.

NOTE

Refer to figure 5-11 for location of controls and indicators on LS-78A.

(1) Set POWER switch (PANEL POWER section) on LS-78A to ON. Allow 15 minutes for warmup. The AC POWER and DC POWER indicators (PANEL POWER section) on LS-78A should light.

NOTE

Observe the correct polarity when connecting leads.

(2) Connect a voltmeter to the VOLTMETER + and VOLTMETER – terminals (INSTRUMENTATION section) on LS-78A.

(3) Set MASTER switch on LS-78A to INTERNAL TESTS +28 VDC position. The voltmeter should indicate +28 volts dc.

(4) Set MASTER switch on LS-78A to INTERNAL TESTS +19 VDC position. The voltmeter should indicate +19 volts dc.

(5) Set MASTER switch on LS-78A to INTERNAL TESTS +13 VDC position. The voltmeter should indicate +13 volts dc.

(6) Set MASTER switch on LS-78A to INTERNAL TESTS +6.2 VDC position. The voltmeter should indicate +6.2 volts dc.

(7) Set MASTER switch on LS-78A to INTERNAL TESTS +4.2 VDC position. The voltmeter should indicate +4.2 volts dc.

(8) Set MASTER switch on LS-78A to INTERNAL TESTS -6.2 VDC position. The voltmeter should indicate -6.2 volts dc.

(9) Set MASTER switch on LS-78A to INTERNAL TESTS LAMP TEST position. All LS-78A indicators should light.

(10) Set MASTER switch on LS-78A to SHUTTER TEST position. All indicators on LS-78A should go out, except DC POWER and AC POWER indicators (PANEL POWER section).

(11) Set SENSOR switch (SHUTTER ASSY section) on LS-78A to CALIBRATE position and FOCAL PLANE SHUTTER switch (SHUTTER ASSY section) on LS-78A to SELF TEST position. The SENSOR CAL indicator (SHUTTER ASSY section) on LS-78A should light.

(12) Set FOCAL PLANE SHUTTER switch (SHUTTER ASSY section) on LS-78A to OFF position. The SENSOR CAL indicator (SHUTTER ASSY section) on LS-78A should go out.

(13) Set all switches and controls on LS-78A to their OFF, neutral, or counterclockwise positions.

(14) Disconnect voltmeter from equipment.

d. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	LS-78A: MASTER switch: CONTROL PANEL POWER switch: (PANEL POWER section): ON *Note.* Allow 15 minutes for warmup.	NA	*a.* Observe DC POWER and AC POWER indicators on (PANEL POWER section) on LS-78A. *b.* Observe front panel edge lamps on photo control panel.	*a.* The DC POWER and AC POWER indicators should light. *b.* The front panel edge lamps should light.
2	NA	NA	Depress and hold OPERATE and READY indicators on photo control panel.	The OPERATE and READY indicators should light when depressed.
3	NA	NA	Release OPERATE and READY indicators on photo control panel.	The OPERATE and READY indicators should go out when released.
4	NA	PHOTO CONTROL PANEL: SYS PWR switch: READY	*a.* Observe READY indicator on photo control panel. *b.* Observe 90° and AUTO indicators (CONTROL PANEL section) on LS-78A.	*a.* The READY indicator should light. *b.* The 90° and AUTO indicators should light.
5	NA	PHOTO CONTROL PANEL: SYS PWR switch: OPERATE	*a.* Observe READY and OPERATE indicators on photo control panel. *b.* Observe OPERATE indicator (CONTROL PANEL section) on LS-78A.	*a.* The READY indicator should remain lit and the OPERATE indicator should remain off. *b.* The OPERATE indicator should light.
6	NA	PHOTO CONTROL PANEL: MOUNT switch L15°	Observe 90° and 15°L indicators (CONTROL PANEL section) on LS-78A.	The 90° indicator should go out and the 15°L indicator should light.
7	NA	PHOTO CONTROL PANEL: MOUNT switch: L30°	Observe 15°L and 30°L indicators (CONTROL PANEL section) on LS-78A.	The 15°L indicator should go out and the 30°L indicator should light.
8	NA	PHOTO CONTROL PANEL: MOUNT switch: R30°	Observe 30°L and 30°R indicators (CONTROL PANEL section) on LS-78A.	The 30°L indicator should go out and the 30°R indicator should light.
9	NA	PHOTO CONTROL PANEL: MOUNT switch: R15°	Observe 30°R and 15°R indicators (CONTROL PANEL section) on LS-78A.	The 30°R indicator should go out and the 15°R indicator should light.
10	NA	PHOTO CONTROL PANEL: MOUNT switch: 90°	Observe 15°R and 90° indicators (CONTROL PANEL section) on LS-78A.	The 15°R indicator should go out and the 90° indicator should light.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
11	NA	PHOTO CONTROL PANEL: MODE switch: PULSE	Observe AUTO, PULSE, and PULSE IMC, indicators (CONTROL PANEL section) on LS-78A.	The AUTO indicator should go out; the PULSE indicator should light; and the PULSE IMC indicator should remain off.
12	NA	PHOTO CONTROL PANEL: MODE switch: PULSE IMC	Observe PULSE and PULSE IMC indicators (CONTROL PANEL section) on LS-78A.	The PULSE indicator should remain on and the PULSE IMC indicator should light.
13	NA	PHOTO CONTROL PANEL: MODE switch: NIGHT	Observe PULSE, PULSE IMC and NIGHT indicators (CONTROL PANEL section) on LS-78A.	The PULSE and PULSE IMC indicators should go out and the NIGHT indicator should light.
14	NA	PHOTO CONTROL PANEL: MODE switch: AUTO	Observe NIGHT and AUTO indicators (CONTROL PANEL section) on LS-78A.	The NIGHT indicator should go out and the AUTO indicator should light.
15	LS-78A: OPERATE switch (CON-PANEL section): Depress and hold.	NA	*a.* Observe FRAMES REMAINING counter on photo control panel. *b.* Observe OPERATE indicator on photo control panel.	*a.* The FRAMES REMAINING counter should indicate 099. *b.* The OPERATE indicator should light.
16	LS-78A: OPERATE switch (CONTROL PANEL section): release	NA	Observe OPERATE indicator on photo control panel.	The OPERATE indicator should go out.
17	LS-78A: TEST switch (CONTROL PANEL section): E V/H	NA	Connect multimeter leads between VOLTMETER + and VOLTMETER – terminals (INSTRUMENTATION section) on LS-78A.	The multimeter should indicate 0 volt dc.
18	NA	PHOTO CONTROL PANEL: V/H switch: MANUAL	Observe multimeter indication	The multimeter should indicate from 26.5 to 29.5 volts dc.
19	NA	PHOTO CONTROL PANEL: V/H switch: AUTO	Observe multimeter indication	The multimeter should indicate 0 volt dc.
20	LS-78A: TEST switch (CONTROL PANEL section): OFF	PHOTO CONTROL PANEL: SYS PWR switch: OFF	*a.* Observe READY indicator on photo control panel. *b.* Observe OPERATE, 90° and AUTO indicators (CONTROL PANEL section) on LS-78A.	*a.* The READY indicator should go out. *b.* The OPERATE, 90° and AUTO indicators should go out.
21	LS-78A: POWER switch (PANEL POWER section): OFF	NA	*a.* Observe front panel edge lamps on photo control panel. *b.* Observe DC POWER and AC POWER indicators (PANEL-POWER section) on LS-78A.	*a.* The front panel edge lamps should go out. *b.* The DC POWER and AC POWER indicators should go out.
22			Disconnect test setup	NA

Section IV. PHOTO SYSTEM ASSEMBLY (UNIT 1)

6-8. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Tool Kit, Photographic Repair TK-77/GF.

(2) Took Kit, Photographic Repair TK-109/GF.

b. Test Connections and Conditions. The physical tests and inspections are performed with the photo system assembly disconnected from all external circuits.

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	NA	NA	*a.* Inspect all mechanical assemblies for loose or missing screws, washers, and nuts.	*a.* Screws, washers, and nuts must be tight; none missing.
			b. Inspect all connectors and sockets, and receptacles, including the fuse holders for looseness and damage.	*b.* No looseness or damage is evident.
2	NA	NA	*a.* Inspect painted surfaces for chips, scratches, and corrosion. ***Note.*** **Touchup painting is recommended in lieu of refinishing whenever practicable. Screw heads, binding posts, receptacles, and plated fastener parts will not be painted or polished with abrasives.**	*a.* Painted surfaces must be free of chips, scratches, and corrosion.
			b. Inspect all panel lettering	*b.* Lettering must be clear and legible.
3	NA	NA	Inspect for proper installation of intervalometer module 1A1, film drive amplifier 1A2, and printed circuit board and component module assembly 1A3.	The three modules must be properly installed.

6-9. Electrical Test

a. Test Equipment and Materials.

(1) Test Set, Analyzer, Camera LS-80A.

(2) Timer, Digital, Electronics LA-387A.

(3) Voltmeter ME-202A/U.

(4) Power Source, 108 to 118 volts ac, single phase, 400 Hz.

(5) Power Source, +24 to +28.5 volts dc.

(6) BNC adapter, PN 1269.

(7) Multimeter TS-352 B/U.

(8) Digital Voltmeter ME-218/GSM-64.

b. Test Connections and Conditions.

(1) Set all switches and controls on LS-80A to their OFF, neutral, or counterclockwise position.

(2) Connect power cable W9 of LS-80A to primary power sources of 115 volts ac, 400 Hz and +28 volts dc, and POWER connector J1 of LS-80A.

(3) Perform initial test equipment calibration (*c* below).

(4) Connect the equipment as shown in figure 5-12. Use digital Voltmeter ME-218/GSM-64 in test setup.

c. Initial Test Equipment Calibration.

NOTE

Refer to figure 5-13 for location of controls and indicators on LS-80A.

(1) Connect multimeter to VOM + and VOM - terminals (MASTER section) on LS-80A. Observe correct polarity and set multimeter to measure negative voltage.

(2) Connect vtvm to DC VOLTS INPUT and DC VOLTS GRD terminals (MASTER section) on LS-80A.

(3) Using adapter (PN 1269), connect input A of digital timer to PULSE TIMER PULSE AND PULSE TIMER GRD terminals (MASTER section) on LS-80A.

(4) Set POWER switch (PANEL POWER section) on LS-80A to ON position. The DC PWR and AC PWR indicators (PANEL POWER section) on LS-80A should light. Allow 15 minutes for warmup.

(5) Set and hold LAMP TEST switch (MASTER section) on LS-80A to ON position. The indicators on LS-80A should all light. Release LAMP TEST switch (MASTER section) on LS-80A.

(6) Set MASTER switch (MASTER section) on LS-80A to INTERNAL TEST 1 position. The COUNTER INTVL, VOM DC, and DC VOLTS indicators (MASTER section) on LS-80A should light. The multimeter should indicate from -20 to -30 volts dc and the vtvm should indicate from -3.24 to -3.44 volts dc.

(7) Momentarily, set CYCLE PULSE switch (CAMERA BODY section) on LS-80A to MANUAL position. The digital timer should indicate from 10 to 15 milliseconds.

(8) Adjust E V/H 0 - 50 VOLTS control (CONTROL-POWER SUPPLY section) on LS-80A to 25.

(9) Set MASTER switch (MASTER section) on LS-80A to INTERNAL TEST 2 position. The COUNTER INTVL and VOM DC indicators (MASTER section) on LS-80A should go out. The vtvm should indicate from 24.9 to 25.1 volts dc.

(10) Set POWER switch (PANEL POWER section) on LS-80A to OFF position. The indicators on LS-80A should all go out.

(11) Set all switches on controls on LS-80A to their OFF, neutral or counterclockwise position.

(12) Disconnect multimeter from test setup.

d. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	LS-80A: E V/H 0.50 VOLTS control (CONTROL POWER SUPPLY section): 25.	NA	NA	NA
2	LS-80A: POWER switch (PANEL POWER section): ON. ***Note.*** **Allow 15 minutes for warmup.**	NA	*a.* Observe DC PWR and AC PWR indicators (PANEL POWER section) on LS-80A. *b.* Observe MOUNT AC indicator (CONTROL-POWER SUPPLY section) on LA-80A.	*a.* The DC PWR and AC POWER indicator should light. *b.* The MOUNT AC indicator should light.
3	LS-80A: TEST switch (CONTROL-POWER SUPPLY section): SYSTEM RDY GRD ON.	NA	*a.* Observe CAM 28V, ACØA, ACØB and VERT POS indicators (CONTROL-POWER SUPPLY section) on LS-80A. *b.* Observe INTVL PULSE indicator (CONTROL-POWER SUPPLY section) on LS-80A.	*a.* The CAM 28V, ACØA, ACØB, and VERT POS indicators should light. *b.* The INTVL PULSE indicator should flash at a slow rate.
4	LS-80A: TEST switch (CONTROL-POWER SUPPLY section): SYSTEM OPERATE	NA	*a.* Observe SYS RDY and INTVL PULSE indicators (CONTROL-POWER SUPPLY section) on LS-80A. *b.* Observe MOUNT AC indicator (CONTROL-POWER SUPPLY section) on LS-80A. *c.* Observe DC VOLTS, SCOPE, COUNTER WIDTH, and COUNTER INTVL indicators (MASTER section) on LS-80A.	*a.* The SYS RDY indicator should light and the INTVL PULSE indicator should flash at a slower rate than in step 3*b* above. *b.* The MOUNT AC indicator should be out. *c.* The DC VOLTS, SCOPE, COUNTER WIDTH, and COUNTER INTVL indicators should light.
5	LS-80A: CONFIGURATION switch (CONTROL-POWER SUPPLY section):	NA	Observe MOUNT AC, VERT POS, and RELAY OPR indicators (CONTROL-POWER SUPPLY section) on LS-80A.	

Step No.	Control settings: Test Equipment		Control settings: Equipment under test	Test procedure	Performance standard		
					MOUNT AC	*VERT POS*	*RELAY OP*
	a. 44 MM VERT				*a.* off	on	off
	b. 3 IN. 15°R				*b.* on	off	on
	c. 3 IN. 30°R				*c.* on	off	on
	d. 3 IN. VERT				*d.* on	on	off
	e. 6 IN. 15°L				*e.* on	off	on
	f. 6 IN. 30°L				*f.* on	off	on
	g. 6 IN. VERT				*g.* on	on	off
	h. 12 IN. 15°L				*h.* on	off	on
	i. 12 IN. 30°L				*i.* on	off	on
	j. 12 IN. VERT				*j.* on	on	off
6	LS-80A: CONFIGURATION switch and E V/H 0-50 VOLTS control (CONTROL-POWER SUPPLY section):		NA	Observe digital voltmeter and digital timer indications.			
	Configuration Switch	*E V/H 0-50 VOLTS Control*			*Digital voltmeter (vdc)*		*Digital timer (sec)*
	a. 44 MM VERT	25			*a.* -9.66 to 10.68		1.144 to 1.33
	b. 3 IN. 15°R	25			*b.* -6.60 to -7.30		1.67 to 1.95
	c. 3 IN. 30°R	25			*c.* -8.37 to -9.25		1.321 to 1.536
	d. 3 IN. VERT	25			*d.* -16.74 to -18.50		0.66 to 0.768
	e. 6 IN. 15°L	25			*e.* -9.23 to -10.20		1.198 to 1.393
	f. 6 IN. 30°L	25			*f.* -14.20 to -15.70		0.778 to 0.905
	g. 6 IN. VERT	1.0			*g.* -1.338 to -1.48		
	h. 6 IN. VERT	2.0			*h.* -2.678 to -2.96		
	i. 6 IN. VERT	5.0			*i.* -6.69 to -7.40		
	j. 6 IN. VERT	10			*j.* -13.38 to -14.80		
	k. 6 IN. VERT	20			*k.* -26.78 to -29.60		0.413 to 0.480
	l. 6 IN. VERT	35			*l.* -46.86 to -51.80		
	m. 6 IN. VERT	50			*m.* -66.95 to -74.00		
	n. 12 IN. 15°L	25			*n.* -18.92 to -20.91		0.599 to 0.699
	o. 12 IN. 30°L	0.5			*o.* ------------		19.47 to 22.63
	p. 12 IN. 30°L	1.0			*p.* ------------		9.73 to 11.31
	q. 12 IN. 30°L	5.0			*q.* ------------		1.974 to 2.263
	r. 12 IN. 30°L	10			*r.* ------------		0.973 to 1.131
	s. 12 IN. 30°L	25			*s.* -29.11 to -32.18		0.3894 to 0.4525
	t. 12 IN. 30°L	42			*t.* ------------		0.232 to 0.269
	u. 12 IN. VERT	10			*u.* -26.78 to -29.6		0.413 to 0.480
	v. 44MM VERT	None			*v.* NA		

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
7	LS-80A: OPERATE OFF switch (CONTROL-POWER SUPPLY section): Depress and hold to obtain performance standard.	NA	*a.* Observe INTVL PULSE and SYS RDY indicators (CONTROL-POWER SUPPLY section) on LS-80A. *Note.* Replace digital voltmeter with vtvm in last setup (fig. 5-12).	*a.* The INTVL PULSE indicator should stop flashing and the SYS RDY indicator should go out.
			b. Observe digital voltmeter and digital timer indications.	*b.* The vtvm and digital timer indicates.
8	LS-80A: E V/H 0-50 VOLTS control (CONTROL-POWER SUPPLY section): 50 LS-80A: PLUS OUTPUT switch (CONTROL-POWER SUPPLY section): Depress and hold to obtain performance standard.	NA	Observe vtvm indication	The vtvm indication should be greater than 3 volts dc.
9	LS-80A: TEST switch (CONTROL POWER SUPPLY section): SYSTEM MAN PIC.	NA	*a.* Observe the MOUNT AC, INTVL PULSE, and MAN PIC indicators (CONTROL-POWER SUPPLY section) on LS-80A.	*a.* The MOUNT AC, INTVL PULSE, and MAN PIC indicators should light.
			b. Observe the DC VOLTS, SCOPE, COUNTER WIDTH, and COUNTER INTVL indicators (MASTER section) on LS-80A.	*b.* The DC VOLTS indicator should light. The SCOPE, COUNTER WIDTH, and COUNTER INTVL indicators should go out.
10	LS-80A: PLUS OUTPUT switch (CONTROL-POWER SUPPLY section): Depress and hold to obtain performance standard.	NA	Observe vtvm indication	The vtvm should indicate from +25 to +31 volts dc.
11	LS-80A: TEST switch (CONTROL-POWER SUPPLY section): SYSTEM NIGHT FLASH.	NA	*a.* Observe NIGHT EXP, FLASH AC, FLASH DC, and INTVL PULSE indicators (CONTROL-POWER SUPPLY section) on LS-80A.	*a.* The NIGHT EXP, FLASH AC, and FLASH DC indicators should light. The INTVL PULSE indicator should flash.
			b. Observe MAN PIC indicator (CONTROL-POWER SUPPLY section) on LS-80A.	*b.* The MAN PIC indicator should go out.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
12	LS-80A: TEST switch (CONTROL-POWER SUPPLY section): SYSTEM FLASH RDY.	NA	Observe SYS RDY indicator (CONTROL-POWER SUPPLY section) on LS-80A.	The SYS RDY indicator should light.
13	LS-80A: POWER switch (PANEL POWER section): OFF	NA	Observe all indicators on LS-80A	The indicators should all go out.
14	------	------	Disconnect test setup.	

Section V. ROTARY MOUNT ACTUATOR (Unit 2)

6-10. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Tool Kit, Photograph Repair TK-77/GF.

(2) Took Kit, Photograph Repair TK-109/GF.

b. Test Connections and Conditions. The physical test and inspections are performed with the rotary mount actuator disconnected from all external circuits.

c. *Procedure.*

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	NA	NA	*a.* Inspect rotary mount actuator for loose or missing screws and washers. *b.* Inspect connector for missing or damaged contacts. *c.* Inspect pinion gear for broken or missing teeth.	*a.* Screws and washers must be tight, none missing. *b.* No contacts shall be missing or damaged. *c.* No teeth on pinion gear shall be broken or missing.

6-11. Electrical Test

a. Test Equipment and Materials.

(1) *Test Equipment.*

(*a*) Power source, +24 to +28.5 volts dc.

(*b*) Power source, 108 to 118. volts ac, single phase, 400 Hz.

(2) *Materials.*

(*a*) Connector MS3116P-20-16S.

(*b*) Terminal board MS27212-1-16.

(*c*) Switch MS35058-22.

(*d*) Switch MS25002-1.

(*e*) Indicator light MS25256-8.

(*f*) Lamp MS25237-327.

(*g*) Wiring, No. 18AWG (as required).

b. Test Connections and Conditions.

WARNING

Make sure that 115 volt ac, 400 Hz, and +28 volt dc power sources are off before performing steps (1) through (4) below. Dangerous voltages of 115 volts ac, 400 Hz, and +28 volts dc are present at terminals when power sources are on.

(1) Fabricate test cable as shown in figure 5-20.

(2) Connect the connector J1 on test cable (fig. 5-20) to connector 2P1 on rotary mount actuator.

(3) Set switches S1 and S2 on test cable to their off positions.

(4) Connect test cable (fig. 5-20) to 115-volt ac, 400-Hz, and +28-volt dc power sources.

(5) Turn ac and dc power sources on.

NOTE

Condition of indicator lamp on test cable is to be disregarded unless otherwise specified.

(6) Set switch S1 of test cable to on position. Allow 15 minutes for warmup.

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	TEST CABLE: Set switch S2 to position 2, 90° vertical.	NA	Index mark pinion gear on output shaft of 430 to 1 gearbox to housing with grease pencil or chalk.	NA
2	TEST CABLE: Set switch S2 to position 3, 15°R.	NA	Pinion gear rotates 2.5 turns clockwise.	Pinion gear shall rotate clockwise 2.5 revolutions.
3	TEST CABLE: Set switch S2 to position 4, 15°L.	NA	Pinion gear rotates 5 turns counterclockwise.	Pinion gear shall rotate counterclockwise 5 revolutions.
4	TEST CABLE: Set switch S2 to position 5, 30°L.	NA	Pinion gear rotates 0.5 turns clockwise.	Pinion gear shall rotate clockwise 0.5 revolutions.
5	TEST CABLE: Set switch S2 to position 6, 30°R.	NA	Pinion gear rotates 4 turns clockwise.	Pinion gear shall rotate clockwise 4 revolutions.
6	TEST CABLE: Set switch S2 to position 2, 90° vertical.	NA	Pinion gear rotates 2 turns counterclockwise.	Pinion gear shall rotate counterclockwise 2 revolutions. Index marks made in step 1 above shall coincide.
7	----------	----------	Disconnect test setup.	NA

Section VI. DOOR ACTUATOR (Unit 4)

6-12. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Took Kit, Photograph Repair TK-77/GF.

(2) Took Kit, Photograph Repair TK-109/GF.

b. Test Connections and Conditions. The physical test and inspections are performed with the door actuator disconnected from all external circuits.

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	NA	NA	*a.* Inspect door actuator for loose or missing screws and washers. *b.* Inspect connector for missing or damaged contacts.	*a.* Screws and washers must be tight, none missing. *b.* No contacts shall be missing or damaged.

6-13. Electrical Test

a. Test Equipment and Materials.

(1) *Test equipment.* A power source from +24 to +28.5 volts dc is required.

(2) *Materials.*

(*a*) Clip, type TC1 per Federal Specification W-C-440.

(*b*) Indicator light MS25256-8 (2).

(*c*) Lamp MS25237-327 (2).

(*d*) Connector MS3100A-14S-5P.

(*e*) Wiring, No. 18 AWG (as required).

b. Test Connections and Conditions.

(1) Fabricate test cable as shown in figure 5-25.

(2) Connect the connector P1 on cable (fig. 5-25) to connector 4J1 on door actuator.

(3) Connect test cable (fig. 5-25) to +28-volt dc power source.

(4) Turn dc power source on. Allow 15 minutes for warmup.

c. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	TEST CABLE: Connect clip to pin B of connector P1 for 12 seconds.	NA	*a.* Measure distance between centers of mounting holes as shown in fig. 5-25. *b.* Extend lamp DS1 on test cable lights.	*a.* Measured distance shall be from 19.65 to 19.73 inches.
2	TEST CABLE: Connect clip to pin A of connector P1 for 12 seconds.	NA	*a.* Measure distance between centers of mounting holes. *b.* Retract lamp DS2 on test cable lights.	*a.* Measured distance shall be from 13.71 to 13.79 inches. *b.* Retract lamp DS2 should light.
3	TEST CABLE: Connect clip to pin B of connector P1 for 12 seconds.	NA	*a.* Measure distance between centers of mounting holes. *b.* Extend lamp DS1 on test cable lights. *c.* Retract lamp DS2 on test cable goes out.	*a.* Measured distance shall be from 19.65 to 19.73 inches. *b.* Extend lamp DS1 should light. *c.* Retract lamp DS2 should be out.
4	NA	NA	Turn off +28-volt dc power source and disconnect test setup.	NA

Section VII. LIGHT SENSOR (Unit 5)

6-14. Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Tool Kit, Photographic Repair TK-77/GF.

(2) Took Kit, Photographic Repair TK-109/GF.

b. Test Connections and Conditions. The physical tests and inspections are performed with the light sensors disconnected from all external circuits.

c. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	NA	NA	*a.* Inspect mechanical assemblies for loose or missing screws, washers, and nuts. *b.* Inspect connector for looseness and damaged or missing pins. *c.* Inspect surface of light sensor for scratches, chips, cracks, dirt, or fingerprints.	*a.* Screws, washers, and nuts must be tight; none missing. *b.* No looseness or damage is evident. *c.* No scratches, chips, cracks, dirt, or finger prints is evident.
2	NA	NA	Inspect all painted surfaces for scratches, nicks, dents, fractures, rust, or corrosion. ***Note.*** **Touchup painting is recommended in lieu of refinishing whenever practicable. Screw heads, binding posts, receptacles, and plated fastener parts will not be repainted or polished with abrasives.**	No scratches, nicks, dents, fractures, rust, or corrosion is evident.
3	NA	NA	Inspect cabling for cuts or cracks.	No cuts or cracks is evident.

6-15. Electrical Test

a. Test Equipment and Materials.

(1) Test Set, Analyzer, Camera LS-80A.

(2) Voltmeter ME-202A/U.

(3) Power source, +24 to +28.5 volts dc.

(4) Power source, 108 to 118 volts ac, single phase, 400 Hz.

(5) Light source, calibrated LA-233A.

(6) Filter, neutral density (25 percent transmissibility) (CAI PN 2998-933-1).

(7) Filter, neutral density (8.0 percent transmissibility) (CAI PN 2998-933-2).

(8) Filter, neutral density (1.6 percent transmissibility) (CAI PN 2998-933-3).

(9) Filter neutral density (0.5 percent transmissibility) (CAI PN 2998-933-3).

b. Test Connections and Conditions.

(1) Set all switches and controls on LS-80A to their OFF, neutral, or counterclockwise positions.

(2) Connect power cable W9 of LS-80A to primary power sources of 115 volts ac, 400 Hz and +28 volts dc, and POWER connector J1 on LS-80A.

(3) Perform initial test equipment calibration (para 6-9*c*).

(4) Connect the light sensor, test equipment, and LS-80A as shown in figure 5-26.

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test Equipment	Equipment under test		
1	LS–80A: POWER switch (PANEL POWER section): ON. *Note.* Allow 15 minutes for warmup.	NA	*a.* Observe DC PWR and AC PWR indicators (PANEL POWER section) on LS–80A. *b.* Observe LS–233A condition	*a.* The DC PWR and AC PWR indicators should light. *b.* The LS–233A should light.
2	LS–80A: MASTER switch (MASTER section): LENS CONE. TEST switch (LENS CONE section): PHOTO SENSOR.	NA	Observe DC VOLTS indicator (MASTER section) on LS–80A.	The DC VOLTS indicator should light.
3	NA	NA	Place light sensor on LA–233A	NA
4	LS–80A: EXP SIGNAL RANGE switch (LENS CONE section): 0–10000.	NA	Adjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS–80A to obtain a null indication on vtvm.	The EXP SIGNAL FOOT-LAMBERTS control setting should be from 1280 to 1920.
5	NA	NA	Install 25 percent neutral density filter (PN 2998–933–1) between light sensor and light surface of LA–233A.	NA
6	NA	NA	Adjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS–80A to obtain a null indication on vtvm.	The EXP SIGNAL FOOT-LAMBERTS control setting should be from 320 to 480.
7	NA	NA	Remove 25 percent neutral density filter from LA–233A and replace with 8 percent neutral density filter (PN 2998–933–2).	NA
8	NA	NA	Adjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS–80A to obtain a null indication on vtvm.	The EXP SIGNAL FOOT-LAMBERTS setting should be from 102.4 to 153.6.
9	NA	NA	Remove 8 percent neutral density filter from LA–233A and replace with 1.6 percent neutral density filter (PN 2998–933–3).	NA

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
10	LS-80A: EXP SIGNAL RANGE switch (LENS CONE section): 0-100.	NA	Adjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A to obtain a null indication on vtvm.	The EXP SIGNAL FOOT-LAMBERTS setting should be from 19.97 to 29.95.
11	NA	NA	Remove 1.6 percent neutral density filter from LA-233A and replace with 0.5 percent neutral density filter (PN 2998-933-4).	NA
12	NA	NA	Adjust EXP SIGNAL FOOT-LAMBERTS control (LENS CONE section) on LS-80A to obtain a null indication on vtvm.	The EXP SIGNAL FOOT-LAMBERTS setting should be from 6.4 to 9.6.
13	LS-80A: POWER switch (PANEL POWER section): OFF	NA	*a.* Observe DC PWR and AC PWR indicators (PANEL POWER section) on LS-80A. *b.* Observe DC VOLTS indicator (MASTER section) on LS-80A. *c.* Observe LS-233A condition	*a.* The DC PWR and AC PWR indicators should go out. *b.* The DC VOLTS indicator should go out. *c.* The LA-233A light should go out.
14	NA	NA	Disconnect test setup	NA

Section VIII. CAMERA MOUNT A (UNIT 11) OR CAMERA MOUNT B (UNIT 12)

6–16. Physical Tests and Inspection

Physical tests and inspection of the camera mount A or camera mount B consists of a visual inspection to insure that this unit is free from breaks or other damage that may impair proper functioning, and that all screws and rivets are properly secured.

6–17. Mechanical Test

a. Test Equipment and Materials.

(1) One-inch micrometer.

(2) Two-inch micrometer.

b. Test Connections and Conditions. Check to insure that all outside and/or inside dimensions of trunnions, bearings and bushings are within the tolerances specified in *c* below.

c. Procedure.

Step No.	Control settings: Test Equipment	Control settings: Equipment under test	Test procedure	Performance standard
1	NA	NA	Check dimensions of—	Tolerance (inches):
			Rear trunnion	Outside bearing diameter, 0.9960 to 0.9976
			Rear bearing	Inside bearing diameter, 1.001 to 1.002
				Outside bearing diameter, 1.0935 to 1.0945
				Width of bearing, 0.700 to 0.710
			Rear bushing	Inside bushing diameter, 1.0935 to 1.0945
				Outside bushing diameter, 1.248 to 1.250
2	NA	NA	Check dimensions of—	Tolreance (inches):
			Front trunnion	Outside bearing diameter, 0.9960 to 0.9976
			Front bearing	Inside bearing diameter, 1.0015 to 1.0030
				Outside bearing diameter, 1.0935 to 1.0945
				Outside bearing flange diameter, 1.5
				Outside bearing flange thickness, 0.040 to 0.045
				Width of bearing, 0.310 to 0.320
			Front bushing	Inside bushing diameter, 1.0935 to 1.0945
				Outside bushing diameter, 1.248 to 1.250
				Outside flange width, 0.750
				Inside flange width, 0.593 to 0.603

Section IX. FLIGHT LINE TRACKER (Unit 13) RIGHT OBLIQUE SIGHT (Unit 14) AND LEFT OBLIQUE SIGHT (Unit 15)

6-18. Flight LineTracker Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Took Kit, Photographic Repair TK-77/GF.

(2) Took Kit, Photographic Repair TK-109/GF.

b. Inspection.

(1) Check all painted surfaces for scratches, nicks, dents, fractures, rust, or corrosion.

(2) Examine unit for loose or missing hardware.

6-19. Right Oblique Sight and Left Oblique Sight Physical Tests and Inspection

a. Test Equipment and Materials.

(1) Took Kit, Photographic Repair TK-77/GF.

(2) Took Kit, Photographic Repair T-109/GF.

b. Inspection.

(1) Check all painted surfaces for scratches, nicks, dents, fractures, rust, or corrosion.

(2) Inspect lenses for scratches, chips, cracks, dirt, or fingerprints.

(3) Examine for loose or missing hardware.

(4) Check rotation of head and pin assembly relative to sight head bracket. Detent action over full range of possible positions should be smooth but positive.

CHAPTER 7

DEPOT MAINTENANCE

7-1. Depot Rebuild Operations

Complete rebuilding of Photographic Surveillance System, Airborne KS-113A (camera control) individual major components will be accomplished by depot maintenance facilities when authorized by Headquarters, Department of the Army. Rebuilding includes all repair, rebuild, and replacement operations necessary to make the equipment equivalent to new material and suitable for return to Department of the Army supply system stocks for reissue to using organization. Detailed procedures for accomplishing the repairs and adjustments established in preceding portions of this manual, and such additional repair and rebuild operations as deemed necessary, will be established by the facility performing the work. Paragraph 7-2 establishes the requirements that must be met by rebuilt or repaired equipment before it is returned to Department of the Army (DA) supply system stocks.

7-2. Final Testing

a. To final test the major components of the camera control system, refer to the applicable test in depot overhaul standards.

b. Major components meeting the test requirements (*a* above) will be returned to DA supply system stocks.

APPENDIX A

REFERENCES

The following publications contain information applicable to direct support, general support, and depot maintenance of Photographic Surveillance System Airborne KS-113A.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U. S. Army Equipment Index of Modification Work Orders.
TM 11-6720-250-12	Operator and Organizational Maintenance Manual: Photographic Surveillance System, Airborne KS-113A.
TM 11-6625-366-15	Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352 B/U.
TM 11-6760-242-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: For Timer, Digital, Electronics LA-387A.
TM 11-6625-537-15-1	Organizational, DS, GS, and Depot Maintenance Manual: Voltmeter Electronic ME-202A/U.
TM 11-6625-1703-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Oscilloscope AN/USM-281A.
TM 11-6760-220-12	Operator and Organizational Maintenance Manual: Test System, Photographic Surveillance LS-34A; Analyzer, Still Picture Camera LS-44A; Test System, Photographic Surveillance System LS-45A; Tool Kit, Still Picture Camera Maintenance LS-48A; Test Set, Converter, Altitude-Ground Speed Ratio LS-50A; Test Set, Scanner Alignment LS-51A; and Test Set, Vacuum Regulator Assembly LA-185A; as Used for Testing: Camera, Still Picture KA-30A; and Photographic Surveillance System, Airborne KS-59( ) and KS-61A.
TM 11-6720-236-12	Operator and Organizational Maintenance Manual: Camera, Still Picture KA-76A and Lens Cones, Camera, Aerial Reconnaissance LA-370A, LA-371A, and LA-372A.
TM 11-6720-236-35	DS, GS and Depot Maintenance Manual: Camera, Still Picture KA-76A and Lens Cones, Camera, Aerial Reconnaissance LA-370A, LA-371A, and LA-372A.
TM 11-6760-228-12	Organizational Maintenance Manual Including Repair Parts and Special Tools Lists: Flasher System Photographic Aircraft LS-59A.
TM 11-6760-228-35-1	DS, GS, and Depot Maintenance Manual: Flasher System Photographic Aircraft LS-59A.

APPENDIX B

DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS

Section I. INTRODUCTION

B–1. Scope

This appendix lists repair parts and special tools required for the performance of direct support, general support, and depot maintenance for the KS–113A.

B–2. General

This repair parts and special tools list is divided into the following sections:

a. Repair Parts—Section II. A list of repair authorized for the performance of maintenance at the direct support, general support, and depot level.

b. Special Tools, Test and Support Equipment—Section III. Not applicable.

c. Index—Federal Stock Number Cross-Reference to Figure and Item Number or Reference Designation—Section IV. A list of Federal stock numbers in ascending numerical sequence followed by a list of reference numbers in ascending alphanumerical sequence, cross-referenced to illustration figure number and reference designation. (Not available)

d. Index—Reference Designation Cross-Reference to Page Numbers—Section V. A list of reference designations cross-referenced to page numbers. (Not available.)

B–3. Explanation of Columns

The following provides an explanation of columns in the tabular lists.

a. Source, Maintenance, and Recoverability Codes (SMR), Column 1.

(1) Source codes, indicate the selection status and source for the list item. Source codes used are—

Code	*Explanation*
P	Repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.
P2	Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
P9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment, which are stocked and supplied by the Army COMSEC logistic system, and which are not subject to the provisions of AR 380–41.
P10	Assigned to items which are NSA design controlled: special tools, test, measuring and diagnostic equipment for COMSEC support, which are accountable under the provisions of AR 380–41 and which are stocked and supplied by the Army COMSEC logistic system.
M	Repair parts which are not procured or stocked, but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies which are not procured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.

Code	*Explanation*
X1	Repair parts which are not procured or stocked. The requirement for such items will be filled by use of the next higher assembly or component.
X2	Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain same through cannibalization. Where such repair parts are not obtainable through cannibalization requirements will be requisitioned, with accompanying justification, through normal supply channels.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above supply level.

(2) Maintenance codes indicate the lowest category of maintenance authorized to install the listed item. The maintenance level codes are—

Code	*Explanation*
C	Operator/crew
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

(3) Recoverability codes indicate whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are—

Code	*Explanation*
R	Repair parts and assemblies that are economically repairable at DSU and GSU activities and normally are furnished by supply on an exchange basis.
S	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	High-dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are repaired or overhauled at depot maintenance activities.
U	Repair parts specifically selected for salvage by reclamation units because of precious metal content critical materials, or high-dollar value reusable casings or castings.

b. Federal Stock Number, Column 2. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description, Column 3. This column indicates the Federal item name and any additional description of the item required. The index number has been included as part of the description to aid in the location of "same as" items. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses.

d. Unit of Measure (U/M), Column 4. A 2-character alphabetical abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ea, pr, etc.

e. Quantity Incorporated in Unit, Column 4. This column indicates the quantity of the item used in the KS-113A. Subsequent appearances of the same item in the same assembly are indicated by the letters "REF".

f. 30-Day DS/GS Maintenance Allowances, Columns 6 and 7.

NOTE

Allowances in GS column are for GS maintenance only.

(1) The allowance columns are divided into three subcolumns. Indicated in each column, is the total quantity of items authorized for the number of equipments supported. Subsequent appearances of the same item will have the letters "REF" in the applicable allowance columns. Items authorized for use as required but not for initial stockage are identified with an asterisk in the allowance column.

(2) The quantitative allowances for DS/GS levels of maintenance will represent initial stockage for a 30 day period for the number of equipments supported.

(3) Determination of the total quantity of parts required for maintenance of more than 100 of these equipments can be accomplished by converting the equipment quantity to a decimal factor by placing a decimal point before the next to last digit of the number to indicate hundredths, and multiplying the decimal factor by the parts quantity authorized in the 51-100 allowance column.

Example: authorized allowance for 51-100 equipments in 40; for 150 equipments multiply 40 by 1.50 or 60 parts required.

g. One-Year Allowances Per 100 Equipments/Contingency Planning Purposes, Column 8. This column indicates opposite the first appearance of

each item the total quantity required for distribution and contingency planning purposes. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments for 1 year.

h. Depot Maintenance Allowance Per 100 Equipments, Column 9. This column indicates opposite the first appearance of each item, the total quantity authorized for depot maintenance of 100 equipments. Subsequent appearances of the same item will have the letters "REF" in the allowance column. Items authorized for use as required but not for initial stockage are identified with an asterisk in the allowance column.

i. Illustration, Column 10. This column is divided as follows:

(1) *Figure number, column 10a.* Indicates the figure number in which the item is shown.

(2) *Item number or reference designation, column 10b.* Indicates the reference designation used to identify the item in the illustration.

B-4. Special Information

a. Repair parts mortality is computed from failure rates derived from experience factors with the individual parts in a variety of equipments. Variations in the specific application and periods of use of electronics equipment, the fragility of electronic piece parts, plus intangible material and quality factors intrinsic to the manufacture of electronic parts, do not permit mortality to be based on hours of end item use. However, long periods of continuous use under adverse conditions are likely to increase repair parts mortality.

b. Parts information for components of the KS-113A listed below are covered in their respective equipment manuals.

Equipment	*Technical manual*
Oblique Sight LA-162A and Oblique Sight LA-163A.	TM 11-6720-212-25P
Camera, Still Picture KA-76A and Lens Cones, Camera, Aerial Reconnaissance LA-370, LA-371A, and LA-372A.	TM 11-6720-236-35
Flasher System Photographic Aircraft LS-59A.	TM 11-6760-228-35

NOTE

Sections IV and V are not available and will be published in a change to this manual.

B-5. Location of Repair Parts

This appendix contains two cross-reference indexes (secs. IV and sec V) to be used to locate a repair part when either the Federal stock number, reference number (manufacturer's part No.), or reference designation is known.

NOTE

The RPSTL for Control Master, Aircraft Camera LA-432A, and Control, Height-Ground Speed Ratio C-8340/A are not available for this publication. These items will be covered in a change to this manual.

B-6. Federal Supply Code for Manufacturers

Not available.

SECTION II REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE		USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
OS	6720-922-5804	A001	ACTUATOR, ROTARY MOUNT LA-409A 134SCAV227-1 074-1-E000 (00607)	1		1										
1D		A002	HOUSING: 074-1-E100 (00607)	1		1										
H	3110-402-5060	A003	BEARING, BALL: F5DDABEC7 (21335)	1		1 3				*	*	1	8	3		
H		A004	BEARING, BALL: S5KDDABEC7 (21335)	1		1 3				*	*	1	8	3		
H		A005	BEARING, BALL: F4DDABEC3 (21335)	1		[illegible] 3				*	*	1	8	3		
H	3110-640-8354	A006	BEARING, BALL: F5DDABEC3 (21335)	2		2 6				*	1	1	13	6		
H	5325-835-7289	A007	GROMMET, RUBBER: MS35490-75 (96906)	1		1 3				*	*	1	8	3		
H	5340-829-2141	A008	INSERT, HELICAL: MS21209F4-15 (96906)	4		4 12				1	1	1	22	12		
D		A009	BLOCK, MOTOR MTG: 074-1-B119 (00607)	1		1										
H		A010	GEARMOTOR, DC BRK: 074-1-D900 102A612 (25140)	1		1 3				*	*	1	8	3		
H	5305-039-9232	A011	SCREW, MACHINE: MS35275-46 (96906)	7		[illegible] 21				1	1	1	33	20		
H	5310-933-8119	A012	WASHER, LOCK: MS35338-80 (96906)	8		8 24				1	1	1	40	25		
H	3020-419-8753	A013	GEAR, WORM: 074-1-C107 (00607)	1		[illegible]				*	*	1	8	3		
2H		A014	KEY, WOODRUFF: 212 (78187)	1		[illegible]										
2H		A015	NUT, PL, HEX: 22NTM26 (22599)	1		1										
H	5340-664-4157	A016	INSERT, HELICAL: MS122196 (96906)	13		3 40				1	1	1	59	40		
H	3040-469-7859	A017	SHAFT, GEAR: 074-1-B140 (00607)	1		1 3				*	*	1	8	3		
H	5315-470-3193	A018	PIN, TAPERED, PL: 074-1-A141 (00607)	1		1 3				*	*	1	8	3		
H	3020-415-1429	A019	GEAR, WORM: 074-1-C106 (00607)	1		1 3				*	*	1	8	3		
	5940-820-6235	A020	TERMINAL, LUG: 15GL4 1416-4 (83330)	5		3 15				1	1	1	27	15		
	5340-803-7307	A021	RING, RETAINING: 5100-25 (79136)	1		1 3				*	*	1	8	3		
	5305-639-8315	A022	SCREW, MACHINE: MS35233-11 (96906)	1		1 3				*	*	1	8	3		
	3120-470-3154	A023	WASHER, THRUST: 074-1-A121-1 (00607)	2		2 6				*	1	1	13	6		
	3120-418-7278	A024	WASHER, THRUST: 074-1-A121-2 (00607)	1		1 3				*	*	1	8	3		
	3120-418-7315	A025	WASHER, THRUST: 074-1-A121-3 (00607)	1		1 3				*	*	1	8	3		
	3120-470-3155	A026	WASHER, THRUST: 074-1-A121-4 (00607)	1		1 3				*	*	1	8	3		
	3120-418-2604	A027	WASHER, THRUST: 074-1-A121-5 (00607)	1		1 3				*	*	1	8	3		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE		(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
PH	3120-448-4647	A028	WASHER, THRUST: 074-1-A121-6 (00607)	1		1 3				*	*	1	8	3		
PH	3120-470-3156	A029	WASHER, THRUST: 074-1-A121-7 (00607)	1		1 3				*	*	1	8	3		
PH	3040-481-3690	A030	SHAFT, SHOULDERED: 074-1-B113 (00607)	1		1 3				*	*	1	8	3		
PH		A031	GEAR, CLUSTER: 074-1-C111 (00607)	1		1 3				*	*	1	8	3		
PH	3020-415-1431	A032	GEAR, PINION: 074-1-C104 (00607)	1		1 3				*	*	1	8	3		
MD	5315-418-2667	A033	KEY: 074-1-A122-2 (00607)	1		1										
PH	5310-068-5401	A034	SCREW, CAP, SCH: MS16996-10 (96906)	1		1 3				*	*	1	8	3		
PH	5310-054-1831	A035	WASHER, LOCK: MS35338-81 (96906)	1		1 3				*	*	1	8	3		
AHS		A036	POWER ASSY: 074-1-C021 (00607)	1		1										
MD		A037	PLATE, TRANS MTG: 074-1-C116 (00607)	1		1										
MD		A038	BLOCK, SPACER: 074-1-A125 (00607)	1		1										
MD		A039	BLOCK, SPACER: 074-1-A126 (00607)	1		1										
MD		A040	POST, SPACER: 074-1-A127 (00607)	3		3										
PH	5940-417-3177	A041	TERMINAL BOARD: 074-1-C123 (00607)	1		1 3				*	*	1	8	3		
PH	5940-660-3759	A042	TERMINAL, STUD: 15ST-C-3 2043-3 (71279)	16		16 50				1	1	2	71	50		
PH	5940-849-6341	A043	TERMINAL, STUD: 15ST-A-3 2040-3 (71279)	2		2 6				*	1	1	13	6		
PH	5950-132-2275	A044	TRANSFORM, PULSE: 074-1-C905 35ZM930 (56289)	2		2 6				*	1	1	13	6		
PH	5910-893-6745	A045	CAP., FXD, CER: CK05CW102M (81349)	13		4 40				1	1	1	59	40		
PH	5961-087-6047	A046	SEMICON, DEV DIO: JAN1N645 (81349)	25		6 75				1	1	2	101	75		
PH	5940-417-3175	A047	TERMINAL BOARD: 074-1-C124 (00607)	1		1 3				*	*	1	8	3		
PH	5940-500-4644	A048	TERMINAL, STUD: 15ST-C-2 2043-2 (71279)	7		4 20				1	1	1	33	20		
PH	5905-190-8889	A049	RES., FXD, COMP: RC20GF101J (81349)	1		1 3				*	*	1	8	3		
PH	5905-185-8516	A050	RES., FXD, COMP: RC42GF103J (81349)	1		1 3				*	*	1	8	3		
PH	5910-106-9365	A051	CAP., FXD, ELECT: CL31CQ1R5MP3 (81349)	1		1 3				*	*	1	8	3		
PH	5310-965-1792	A052	WASHER, FLAT: MS15795-802 (96906)	10		6 20				1	1	1	33	20		
PH	5310-928-2960	A053	WASHER, LOCK: MS35338-77 (96906)	17		7 20				1	1	1	33	20		
PH	5305-727-8833	A054	SCREW, MACHINE: MS35249-10 (96906)	10		10 30				1	1	1	46	30		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE		USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
	5305-054-5649	A055	SCREW, MACHINE: MS35233-15 (96906)	2		2 6				*	1	1	13	6		
	5310-933-8118	A056	WASHER, LOCK: MS35338-78 (96906)	20		20 60				1	1	2	71	50		
	5305-054-5650	A057	SCREW, MACHINE: MS35233-16 (96906)	3		3 [illegible]				*	1	1	18	9		
	5305-022-7058	A058	SCREW, MACHINE: MS35249-22 (96906)	[illegible]		2 6				*	1	1	13	6		
	5310-880-5978	A059	WASHER, FLAT: MS15795-807 (96906	4		4 12				1	1	1	22	12		
	5950-419-5341	A060	TRANSFORM, POWER: 074-1-D902 ETC228701 (72149)	[illegible]		1 3				*	*	1	8	3		
	5310-934-9748	A061	NUT, PL, HEX: MS35649-44 (96906)	5		5 15				1	1	1	27	15		
	5940-820-6235	A062	TERMINAL, LUG: SAME AS (A020) 15GL-4 (00607)	REF		2										
	5961-983-7279	A063	SEMICON DEV, DIO: JAN2N1777A (81349)	4		4 12				1	1	1	22	12		
		A064	INSULATOR: 835-14-A101 (00607)	4		4										
	5946-681-8184	A065	TERMINAL, LUG: MS35431-8 (96906)	[illegible]		4 12				1	1	1	22	12		
	5305-764-0064	A066	SCREW, MACHINE: MS35249-39 (96906)	[illegible]		2 6				*	1	1	13	6		
		A067	BUSHING, SPACER: 074-1-A117 (00607)	[illegible]		2										
	5305-022-7100	A068	SCREW, MACHINE: MS35249-36 (96906)	[illegible]		1 3				*	*	1	8	3		
	5305-817-1284	A069	SETSCREW: MS51030-17 (96906)	4		4 12				1	1	1	22	12		
	5315-702-9651	A070	PIN, DOWEL: MS16555-618 (96906)	4		4 12				1	1	1	22	12		
	5305-925-4777	A071	SCREW, MACHINE: MS35275-31 (96906)	2		2 3				*	*	1	8	3		
	5305-543-2580	A072	SCREW, MACHINE: MS35233-43 (96906)	1		1 3				*	*	1	8	3		
	5935-086-2403	A073	CONN, RECP, ELEC: MS3116P20-16P (96906)	1		1 3				*	*	1	8	3		
S		A074	POT., LIMIT SW: 074-1-C022 (00607)	[illegible]		1										
		A075	PLATE, MTG: 074-1-C115 (00607)	1		1										
	5905-471-6119	A076	RES., VARIABLE: 074-1-D901 CKD376 (02111)	1		1 3				*	*	1	8	3		
		A077	SWITCH, LIMIT: 074-1-D904 104743 (08127)	1		1 3				*	*	1	8	3		
	5340-020-3126	A078	CLAMP, COMPONENT: 30900-1 (00607)	6		6 18				1	1	1	33	20		
	4920-715-7033	A079	CLAMP, GEAR: 4B-18 (00607)	1		1 3				*	*	1	8	3		
		A080	COLLAR: 4R-18 (00607)	1		1 3										
	3020-190-8890	A081	GEAR ASSY: 174-3-86 (00607)	1		1 3				*	*	1	8	3		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE		USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
PH	3020-242-2934	A082	GEAR ASSY: 074-1-B130 (00607)	1		1 3				*	*	1	8	3		
PH	5910-893-6745	A083	CAP., FXD, CER: SAME AS (A045)	REF		2										
PH	5305-531-9521	A084	SCREW, MACHINE: MS35233-3 (96906)	6		6 18				1	1	1	33	20		
PH	5310-928-2960	A085	WASHER, LOCK: SAME AS (A053)	REF		6										
MD		A086	PLATE, IDENT: 074-1-C001 (00607)	1		1										
PH	5305-550-5001	A087	SCREW, MACHINE: MS35233-12 (96906)	4		4 12				1	1	1	22	12		
PH	5320-660-1094	A088	RIVET, SOLID: MS20426A2-4 (96906)	3		3 9				*	1	1	18	9		
PH	5330-448-4696	A089	GASKET, END: 074-1-C105 (00607)	1		1 3				*	*	1	8	3		
PH	5330-448-4698	A090	GASKET, TOP: 074-1-C128 (00607)	1		1 3				*	*	1	8	3		
PH	5330-421-7936	A091	GASKET, END: 074-1-C129 (00607)	1		1 3				*	*	1	8	3		
MD		A092	BRACKET, SUPPORT: 074-1-A142 (00607)	1		1										
MD		A093	COVER, END: 074-1-D108 (00607)	1		1										
MD		A094	COVER, END: 074-1-C109 (00607)	1		1										
MD		A095	COVER, TOP: 074-1-D114 (00607)	1		1										
PH	5305-054-5638	A096	SCREW, MACHINE: MS35233-4 (96906)	5		5 15				1	1	1	27	15		
PH	5305-531-9520	A097	SCREW, MACHINE: MS35233-2 (96906)	3		3 9				*	1	1	18	9		
PH	5305-638-0653	A098	SCREW, MACHINE: MS35233-14 (96906)	13		13 40				1	1	1	59	40		
AHS		A099	ELEC CKT ASSY: 074-10-C000 (00607)	1		1										
PHS		A100	CARD ASSEMBLY: 074-10-D022 (00607)	1		1 3				*	*	1	8	3		
X1		A101	CIRCUIT CARD: 074-10-D103 (00607)	1		1										
PD	5940-409-9194	A102	TERMINAL, STUD: 2751-2 (71279)	4		4 12							22	12		
PD	5940-926-0015	A103	TERMINAL, STUD: 2754-2 (71279)	11		7 35							46	30		
PD	5940-500-4644	A104	TERMINAL, STUD: SAME AS (A048)	REF		3										
PD	5910-893-6745	A105	CAP., FXD, CER: SAME AS VNAW (A045) CK05CW102M (81349)	REF		3										
PD	5910-936-1522	A106	CAP., FXD, ELECT: CS13BE106K (81349)	2		2 6							13	6		
PD	5910-087-4211	A107	CAP., FXD, ELECT: CL65CG101MP3 (81349)	2		2 6							10	4		
PD	5910-847-7288	A108	CAP., FXD, CER: CK06CW103M (81349)	3		1 9							18	9		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE		USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
PD	5962-937-9056	A110	COMPARATOR, MODULE, SIGNAL: 074-1-D906 U5B771031X (07263)	4		4 12							22	12		
PD	5940-725-2974	A112	TERMINAL, STUD: 15ST-D-2 2042-2 (71279)	8		2 25							40	25		
PD	5961-087-6047	A113	SEMICON DEV, DIO: SAME AS (A046)	REF		13										
PD	5961-821-7309	A114	SEMICON DEV, DIO: JAN1N751A (81349)	1		1 3							8	3		
PD	5961-845-6458	A115	SEMICON DEV, DIO: JAN1N756A (81349)	2		2 6							13	6		
PD	5961-892-0889	A116	SEMICON DEV, DIO: JAN1N938B (81349)	1		1 3							13	[illegible]		
PD	5961-847-5246	A117	SEMICON DEV, DIO: JAN1N746A (81349)	2		2 6							13	6		
PD	5910-115-8405	A118	CAP., FXD, CER: CK06CW333K (83?49)	2		2 6							13	6		
PD	5905-806-0636	A119	RES., FXD, COMP: RC07GF330J (81349)	2		2 6							13	6		
PD	5905-683-2239	A120	RES., FXD, COMP: RC07GF201J (81349)	1		1 3							8	3		
PD	5905-681-6462	A121	RES., FXD, COMP: RC07GF102J (81349)	2		2 6							13	6		
PD	5905-114-0708	A122	RES., FXD, COMP: RC07GF202J (81349)	2		2 6							13	6		
PD	5905-682-4097	A123	RES., FXD, COMP: RC07GF302J (81349)	1		1 3							8	3		
PD	5905-682-4098	A124	RES., FXD, COMP: RC07GF392J (81349)	2		2 6							13	6		
PD	5905-111-1679	A125	RES., FXD, COMP: RC07GF512J (81349)	8		6 25							40	25		
PD	5905-683-2238	A126	RES., FXD, COMP: RC07GF103J (81349)	1		1 3							8	3		
PD	5905-681-8818	A127	RES., FXD, COMP: RC07GF153J (81349)	1		1 3							8	3		
PD	5905-803-2908	A128	RES., FXD, COMP: RC07GF303J (81349)	1		1 3							8	3		
PD	5905-136-3890	A129	RES., FXD, COMP: RC07GF513J (81349)	3		3 9							18	9		
PD	5905-686-9997	A130	RES., FXD, COMP: RC07GF682J (81349)	1		1 3							8	3		
PD	5905-777-6846	A131	RES., FXD, FILM: RN60C1400F (81349)	1		1 3							8	3		
PD	5905-847-3432	A132	RES., FXD, FILM: RN60C2490F (81349)	1		1 3							8	3		
PD	5905-882-7890	A133	RES., FXD, FILM: RN60C3480F (81349)	1		1 3							8	3		
PD	5905-892-0476	A134	RES., FXD, FILM: RN60C6340F (81349)	1		1 3							8	3		
PD	5905-843-6621	A135	RES., FXD, FILM: RN60C1691F (81349)	1		1 3							8	3		
PD	5905-059-9104	A136	RES., FXD, FILM: RN60C3241F (81349)	1		1 3							8	3		
PD	5905-686-3379	A137	RES., FXD, FILM: RN60C1002F (81349)	4		4 12							22	12		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION		(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
		REFERENCE NUMBER & MFR. CODE														
PD	5905-835-1022	A138	RES., VARIABLE: RA10LASM252A (81349)	2		2 6							13	6		
PD	5970-234-3508	A139	WASHER, INSUL: 074-10-A104 (00607)	2		2 6							13	6		
PD	5961-752-6081	A140	TRANSISTOR: JAN2N657 (81349)	12		10 40							59	40		
PD	5961-929-3715	A141	PAD, TRANSISTOR: 10007 (07047)	14		10 45							59	40		
PHS	6760-938-0306	A142	CIRCUIT CARD ASSEMBLY: 074-10-C021 (00607)	1		1 3				*	*	1	8	3		
X1		A143	CIRCUIT CARD: 074-10-C102 (00607)	1		1 3										
PD	5940-926-0015	A144	TERMINAL, STUD: SAME AS (A103) 2754-2 (71279)	REF		4										
PD	5310-686-1593	A145	FASTENER: KFS2-256 (46384)	4		4 12							53	50		
PD	5910-787-2109	A146	CAP., FXD, ELECT: CS13BF105K (81349)	2		2 6							14	12		
PD	5910-847-7288	A147	CAP., FXD, CER: SAME AS (A108)	REF		2										
PD	5961-087-6047	A148	SEMICON DEV, DIO: SAME AS (A046)	REF		6										
PD	5905-682-4109	A149	RES., FXD, COMP: RC07GF561J (81349)	2		2 6							14	12		
PD	5905-686-9996	A150	RES., FXD, COMP: RC07GF821J (81349)	2		2 6							14	12		
PD	5905-683-7723	A151	RES., FXD, COMP: RC07GF152J (81349)	2		2 6							14	12		
PD	5905-111-1679	A152	RES., FXD, COMP: SAME AS (A125)	REF		2										
PD	5905-120-0167	A153	RES., FXD, COMP: RC32GF511J (81349)	2		2 6							14	12		
PD	5961-926-2569	A154	TRANSISTOR: JAN2N491 (81349)	2		2 6							14	12		
PD	5961-752-6081	A155	TRANSISTOR: SAME AS (A140)	REF		2										
PD	5961-929-3715	A156	PAD, TRANSISTOR: SAME AS (A141)	REF		4										
MD		A157	PLATE, INSUL: 074-10-B106 (00607)			1										
MD		A158	SPACER: 074-10-A105 (00607)	4		4										
PH	5305-543-2760	A159	SCREW, MACHINE: MS35233-5 (96906)	4		4 12				1	1	1	22	12		
X2H	5310-965-1792	A160	WASHER, FLAT: SAME AS (A052)	REF		4										
X2H	5310-928-2960	A161	WASHER, LOCK: SAME AS (A053)	REF		4										
PH	5910-883-5712	A162	CAP., FXD, CER: CK06CW103K (81349)	2		2 6				*	1	1	13	6		
PH	5905-810-7786	A163	RES., FXD, FILM: RN60C1581F (81349)	1		1 3				*	*	1	8	3		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
PH	5905-847-5058	A164 RES., FXD, FILM: RN60C8450F (81349)	1		1 3				*	*	1	8	3		
PH	5905-471-4630	A165 RES., VARIABLE: 074-1-A907 (00607)	1		1 3				*	*	1	8	3		
PH	5915-132-2324	A166 FILTER, RFI: 074-1-D903 RF2847A (13619)	1		1 3				*	*	1	8	3		
PH	5310-011-1041	A167 WASHER, LOCK: MS35338-79 (96906)	6		6 18				1	1	1	33	20		
PH	5310-062-0912	A168 NUT, PL, HEX: MS35649-64 (96906)	2		2 6				*	1	1	13	6		
PH	5905-081-0331	A169 RES., FXD, WW: RE65G1501 (81349)	1		1 3				*	*	1	8	3		
PH	5940-071-3593	A170 TERMINAL, STUD: 4882-1-05-16 (71279)	5		5 15				1	1	1	27	15		
X2H		A171 CLAMP, LOOP: 1-8JNA (95987)	1		1										
MD		A172 BLOCK, BRG: 074-1-B137 (00607)	1		1										
PH	5310-350-4316	A173 NUT, BEARING: 074-1-B138 (00607)	1		1 3				*	*	1	8	3		
PH	3110-419-3387	A174 BEARING, BALL: SFR168PPK13 (83086)	1		1 3				*	*	1	8	3		
MD		A175 SHIM: 074-1-A139 (00607)	AR		AR										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION		(3) USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
			REFERENCE NUMBER & MFR. CODE													
GCS	6760-014-8305	A001	CONTROL, POWER SUPPLY LA-406A 134SCAV225-1 (11871) 7845-300	1		1										
PF	5915-226-7900	A002	AC FILTER: 5525-152-1 (11871)	1		1 4	*	*	1	*	*	1	10	4		
PF	5945-802-6699	A003	RELAY: 5605-182-5 3S2791FB100K9 (01526)	2		2 8	*	1	1	*	1	1	16	8		
PF	5915-993-0982	A004	FILTER: 5638-139 (11871)	1		1 3	*	*	1	*	*	1	8	3		
POS	6730-070-4837	A005	INTERVALOMETER: 6055-116 (11871)	1		1 4	*	*	1	*	*	1	8	4		
X10		A006	CIRCUIT BOARD: 6055-191 (11871)	1		1										
PH	6960-070-4838	A007	PRE-AMPLIFIER: 6055-119 (11871)	1		1 3				*	*	1	8	3		
X1H		A008	CUP: 6055-180 (11871)	1		1										
X1H		A009	CIRCUIT BOARD: 6055-160 (11871)	1		1										
PH	5905-784-2194	A010	RESISTOR: 6052-138-4 50-9-230-103 (02111)	4		1				1	1	1	22	12		
X1H		A011	RESISTOR: 6052-138-5 50-9-230-202 (02111)	1		1										
PH	5961-903-4349	A012	TRANSISTOR: 6052-136 231K5 (07713)	4		2 12				1	1	1	22	12		
X1H		A013	TRANSISTOR: 2N328A (81349)	2		2										
X1H		A014	THERMISTOR ASSY: 6055-197 (11871)	2		1										
PH	5961-752-6121	A015	DIODE: 1N753A (81349)	4		2 12				1	1	1	22	12		
PH	5961-729-5499	A016	DIODE: 1N486B (81349)	5		2 15				1	1	1	27	15		
PH		A017	RESISTOR: RN60C3003F (81349)	5		4 15				1	1	1	27	15		
X1H		A018	RESISTOR: RN60C5003F (81349)	1		1				1	1	1	27	15		
X1H		A019	RESISTOR: RN60C3002F (81349)	2		2										
PH		A020	RESISTOR: RN60C5002F (81349)	4		1 12				1	1	1	22	12		
X1H		A021	RESISTOR: RN60C7800F (81349)	1		1										
X1H		A022	RESISTOR: RN60C9501F (81349)	1		1										
X1H		A023	RESISTOR: RC20GF332J (81349)	3		1										
PH	5910-925-6457	A024	CAPACITOR: 5602-280-9 F70K334 (96733)	1		1 3				*	*	1	8	3		
PH	5961-068-1987	A025	TRANSISTOR PAD: TP501 (08289)	11		2 30				1	1	1	46	30		
X1H		A026	CIRCUIT BOARD: 6055-161 (11871)	1		1										
PH	5961-080-7131	A027	SEMICONDUCTOR: 5260-1085-3 UT235 (12969)	2		2 6				*	1	1	13	6		

SECTION II REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
PH	5310-080-4503	A028 NUT: 68NTM62 (72962)	18		2 40				1	1	1	59	40		
PH	5961-068-1987	A029 TRANSISTOR PAD: SAME AS (A025)	REF		9										
PH	5910-851-1275	A030 CAPACITOR: CL21CN010SP3 (81349)	3		1 9				*	1	1	18	9		
PH	5910-087-0590	A031 CAPACITOR: CL33CNR25MN3 (81349)	1		1 3				*	*	1	8	3		
PH		A032 CAPACITOR: 2998-275 29F2131G2 (06001)	2		2 6				*	1	1	13	6		
PH	5905-868-8642	A033 CAPACITOR: 6055-173 (11871)	1		1 3				*	*	1	8	3		
PH	5910-785-8898	A034 CAPACITOR: 2998-1014-1 AG2-473D (99515)	1		1 3				*	*	1	8	3		
PH		A035 CAPACITOR: 2950-493-17 150D104X5020A2 (80183)	1		1 3				*	*	1	8	3		
PH		A036 SEMICONDUCTOR: 1N645M (81349)	13		7 40				1	1	1	59	40		
PH	5961-855-8569	A037 SEMICONDUCTOR: 1N975B (81349)	2		2 6				*	1	1	13	6		
PH	5961-990-9871	A038 SEMICONDUCTOR: 6055-169-1 1N1740A (99942)	1		1 3				*	*	1	8	3		
PH	5961-892-0919	A039 SEMICONDUCTOR: 1N3031B (81349)	1		1 3				*	*	1	8	3		
PH	5961-842-8797	A040 SEMICONDUCTOR: 1N3034B (81349)	1		1 3				*	*	1	8	3		
PH	5961-729-5499	A041 SEMICONDUCTOR: SAME AS (A016)	REF		1										
PH	5961-784-7747	A042 SEMICONDUCTOR: 6055-171-1 4E30M3 (05292)	1		1 3				*	*	1	8	3		
PH	5945-880-6846	A043 RELAY: 2060-437-13 P26C1P6AS10 (99699)	1		1 3				*	*	1	8	3		
PH	5961-954-2271	A044 SEMICONDUCTOR: 6055-170-1 2N1566A (01295)	3		3 9				2	2	1	32	25		
PH	5961-929-2969	A045 SEMICONDUCTOR: 6800-3123-2 2N3495 (04713)	1		1 3				*	*	1	8	3		
PH	5905-195-6806	A046 RESISTOR: RC20GF102J (81349)	1		1 3				*	*	1	8	3		
PH	5905-185-8510	A047 RESISTOR: RC20GF103J (81349)	1		1 3				*	*	1	8	3		
PH	5905-279-2616	A048 RESISTOR: RC20GF153J (81349)	1		1 3				*	*	1	8	3		
PH	5905-279-3500	A049 RESISTOR: RC20GF183J (81349)	1		1 3				*	*	1	8	3		
PH	5905-171-2004	A050 RESISTOR: RC20GF223J (81349)	1		1 3				*	*	1	8	3		
PH	5905-195-0667	A051 RESISTOR: RC20GF224J (81349)	1		1 3				*	*	2	8	3		
PH	5905-279-3499	A052 RESISTOR: RC20GF273J (81349)	1		1				*	*	1	8	3		
PH	5905-192-4490	A053 RESISTOR: RC20GF330J (81349)	1		1 3				*	*	1	8	3		
X1H		A054 RESISTOR: SAME AS (A023)	REF		2										
PH	5905-171-1998	A055 RESISTOR: RC20GF333J (81349)	1		1				*	*	1	8	3		

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PH	5905-171-2001	A056	RESISTOR: RC20GF362J (81349)	1		1 3				*	*	1	8	3		
PH	5905-141-0599	A057	RESISTOR: RC20GF393J (81349)	1		1 3				*	*	1	8	3		
PH	5905-279-3504	A058	RESISTOR: RC20GF472J (81349)	2		2 6				*	1	1	13	6		
PH	5905-279-3503	A059	RESISTOR: RC20GF682J (81349)	2		2 6				*	1	1	13	6		
PH	5905-299-2013	A060	RESISTOR: RC32GF473J (81349)	1		1 3				*	*	1	8	3		
PH		A061	RESISTOR: RN60C3300F (81349)	1		1 3				*	*	1	8	3		
PH		A062	RESISTOR: RN60C6491F (81349)	1		1 3				*	*	1	8	3		
PH	5905-807-3338	A063	RESISTOR: RN70C2003F (81349)	1		1 3				*	*	1	8	3		
PH		A064	RESISTOR: RW67G512 (81349)	2		2 6				*	1	1	13	6		
PH	5905-844-6057	A065	RESISTOR: RLS5-8K3PCT (91637)	1		1 3				*	*	1	8	3		
PH	5905-782-0260	A066	RESISTOR: 1A1B5KOHMPORM5PCT	1		1 3				*	*	1	8	3		
PH	5905-868-2440	A067	RESISTOR: 21TD1 (90634)	1		1 3				*	*	1	8	3		
PH	5905-784-2194	A068	RESISTOR: SAME AS (A010)	REF		3										
PH	5935-850-7817	A069	TEST JACK: 119437H (78947)	7		3 20				1	1	1	32	20		
PH		A070	INSULATOR: 6055-199 (11871)	1		1 3				*	*	1	8	3		
PH	5961-855-1551	A071	TRANSISTOR: 2N1132 (81349)	2		2 6				*	1	1	13	6		
POS	6760-484-8432	A072	BOARD ASSY: 6055-117-2 (11871)	1		1 3	*	*	1	*	*	1	8	3		
PHS	6760-070-4840	A073	RECTIFIER ASSY: 6055-110 (11871)	1		1 3				*	*	1	8	3		
MD		A074	COVER ASSY: 6055-162 (11871)	1		1										
MD		A075	COVER: 6055-132 (11871)	1		1										
MD		A076	COVER: 6055-132-1 (11871)	1		1										
MD		A077	BRACKET: 6055-132-2 (11871)	2		2										
MD		A078	CONTACT STRIP: 6055-195 (11871)	1		1										
PH	5320-182-6209	A079	RIVET: 5413-246-3 (11871)	2		2 6				*	1	1	13	6		
MD		A080	BASE ASSY: 6055-131 (11871)	1		1										
MD		A081	BASE: 6055-142 (11871)	1		1										

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE		USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
PH	5310-826-3540	A082	NUT, CLINCH: 2704-310-5 22NCFMA1-26 (72962)	4		4 12				1	1	1	22	12		
MD		A083	BRACKET, SMALL: 5525-131 (11871)	1		1										
PH	5320-558-9040	A084	RIVET: MS20470A2-3 (96906)	2		2 6				*	1	1	13	6		
MD		A085	BRACKET: 6055-127 (11871)	1		1										
PH	5905-984-2765	A086	TRANSFORMER: 5606-194 (11871)	1		1 3				*	*	1	8	3		
PH	6720-331-3800	A087	NETWORK: 5602-347-1 (11871)	1		1				*	*	1	8	3		
PH	5950-071-2169	A088	COIL: 5525-154 (11871)	4		4 12				1	1	1	22	12		
PH	5310-614-3500	A089	NUT: 2700-305-7 68-1660-40 (72962)	30		3 90				1	2	3	130	100		
PH	5305-543-2768	A090	SCREW: MS35233-19 (96906)	1		1 3				*	*	1	8	3		
PH	5305-550-5002	A091	SCREW: MS35233-13 (96906)	2		2 6				*	1	1	13	6		
PH	5305-531-9520	A092	SCREW: MS35233-2 (96906)	4		4 12				1	1	1	22	12		
PH		A093	RESISTOR: RC12GF101J (81349)	1		1 3				*	*	1	8	3		
PH	5961-892-0804	A094	TRANSISTOR: 2N685 (81349)	2		2 6				*	1	1	13	6		
PH	5961-855-7224	A095	DIODE: 1N1616 (81349)	2		2 6				*	1	1	13	6		
PH	5940-553-2471	A096	STANDOFF: 2704-208-1 RSTSM1TUR (05009)	8		8				1	1	1	40	25		
PH	5910-880-8710	A097	CAPACITOR: 6055-177-1 DA722 (71590)	6		6 18				1	1	1	33	20		
PH		A098	TERMINAL: 688 (03253)	2		2 6				*	1	1	13	6		
PH	5310-833-6473	A099	WASHER: CAV10-14P (11871)	2		2 6				*	1	1	13	6		
PH	5310-753-3991	A100	WASHER: CAV10-87P (11871)	6		6 18				1	1	1	33	20		
PH	5310-579-2180	A101	WASHER: CAV10-88P (11871)	2		2 6				*	1	1	13	6		
MD		A102	INSULATOR: 6055-121 (11871)	2		2										
PH	6760-070-4841	A103	TRANSISTOR ASSY: 6055-120 (11871)	1		1 3				*	*	1	8	3		
X1H		A104	COVER: 5525-121 (11871)	1		1										
X1H		A105	BASE: 5525-122 (11871)	1		1										
PH	5961-903-4349	A106	TRANSISTOR DUAL: SAME AS (A012)	REF		2										
X1H		A107	THERMISTOR ASSY: SAME AS (A014)	REF		1										
PH	5910-951-9852	A108	CAPACITOR: DE2-473 (99515)	1		1 3				*	*	1	8	3		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
PH	5310-822-3840	A109 NUT: 2700-305-3 68-1660-26 (72962)	18		4 60				1	1	2	71	50		
PH	5305-055-0995	A110 SCREW: CAV70-2-4P (11871)	4		4 12				1	1	1	33	20		
PH	5305-655-5991	A112 SCREW: CAV70-6-5P (11871)	11		1 30										
X1H		A113 CIRCUIT BOARD: 6055-192-1 (11871)	1		1										
PH	5961-068-1987	A114 TRANSISTOR PAD: SAME AS (A025)	REF		3										
PH	5905-723-9630	A115 RESISTOR: RC12GF223J (81349)	1		1 3				*	*	1	8	3		
PH		A116 RESISTOR: RC12GF225J (81349)	1		1 3				*	*	1	8	3		
PH		A117 RESISTOR: RC12GF272J (81349)	1		1 3				*	*	1	8	3		
PH	5905-931-9897	A118 RESISTOR: RC12GF473J (81349)	1		1 3				*	*	1	8	3		
PH	5905-755-8132	A119 RESISTOR: RN60C1003F (81349)	1		1 3				*	*	1	8	3		
PH	5905-833-5819	A120 RESISTOR: RN60C2003F (81349)	3		3 9				2	2	2	32	25		
PH		A121 RESISTOR: SAME AS (A017)	REF		1										
PH		A122 RESISTOR: SAME AS (A020)	REF		3										
PH		A123 RESISTOR: RN60E2003D (81349)	1		1 3				*	*	1	8	3		
PH	5905-226-7897	A124 TRANSFORMER: 2998-1013-1 TTX107SE (04879)	1		1 3				*	*	1	8	3		
PH	5961-729-5499	A125 DIODE: SAME AS (A016)	REF		2										
PH		A126 DIODE: SAME AS (A036)	REF		6										
PH	5961-752-6121	A127 DIODE: SAME AS (A015)	REF		2										
PH	5961-926-7310	A128 TRANSISTOR: 2N492 (81349)	1		1 3				*	*	1	8	3		
PH		A129 TRANSISTOR: 2N1469M (81349)	2		2 6				*	*	1	13	6		
PH	5910-851-1275	A130 CAPACITOR: SAME AS (A030)	REF		2										
PH	5910-893-6745	A131 CAPACITOR: CK05CW102K (81349)	2		2 6				*	1	1	13	6		
PH	5905-784-2194	A132 RESISTOR: SAME AS (A010)	REF		2										
PH	5935-850-7817	A133 TEST JACK: SAME AS (A069)	REF		4										
PH	5905-899-7945	A134 RESISTOR: RC12GF563J (81349)	1		1 3				*	*	1	8	3		
PH	5310-802-7924	A135 WASHER: CAV10-36P (11871)	1		1				*	*	1	8	3		
PH	5310-929-6395	A136 WASHER: MS35338-136 (96906)	1		1 3				*	*	1	8	3		
PH	5910-785-9012	A137 CAPACITOR: 6055-174-1 E2510 (83125)	1		1 3				*	*	1	8	3		

SECTION II REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
PH	5935-913-5164	A138 CONNECTOR: 6055-201-1 (11871)	1		1 4				*	*	1	10	4		
PH	5935-913-1103	A139 CONNECTOR: 6055-201-2 (11871)	1		1 4				*	*	1	10	4		
PF	5915-922-7310	A140 FILTER: 6162-166 (11871)	1		1 3	*	*	1	*	*	1	8	3		
X1F		A141 CAPACITOR: 5602-280-17 EP15C12 (99515)	1		1										
X1F		A142 COIL: 6054-198-1 (11871)	2		2										
X1F		A143 TERMINAL: CCAS93TL6X90DEG (85916)	2		2										
X1F		A144 CAPACITOR: 815Z5R103K (85916)	3		3										
X1F		A145 COVER: 6162-166-1 (11871)	1		1										
X1F		A146 CAN: 6162-166-2 (11871)	1		1										
PF		A147 METER: 6254-318-6 E19271 (82227)	1		1 3	*	*	1	*	*	1	8	3		
PF		A148 RELAY: 6800-3087-3 DK2N006 (35344)	1		1 3	*	*	1	*	*	1	8	3		
PF	5915-932-6371	A149 FILTER: 7320-990 (11871)	1		1 3	*	*	1	*	*	1	8	3		
PF	5945-900-4865	A150 RELAY: 7438-732-1 BR14X150B7-26V (09026)	1		1 3	*	*	1	*	*	1	8	3		
MD		A151 CHASSIS ASSY 7845-310 (11871)	1		1										
MD		A152 CHASSIS 7845-310-1 (11871)	1		1										
PH	5325-685-0615	A153 EYELET: 2700-304-16 SE45 (07707)	2		2 6				*	1	1	13	6		
PH	5320-165-8768	A154 RIVET: MS20426B3-5 (96906)	6		4				1	1	1	33	20		
PH	5340-819-8882	A155 CLIP: 6018-5C (91506)	1		1 3				*	*	1	8	3		
PH	5940-106-5932	A156 TERMINAL: STSM1TUR (05009)	13		11 50				1	1	2	71	50		
PH	5940-682-9080	A157 TERMINAL: 2704-208-2 RSTSM38TUR (05009)	2		2 10				*	1	1	19	10		
PH	5325-355-8963	A158 SPRING: S4-200 (72794)	3		2 6				*	1	1	13	6		
PH	5310-027-7247	A159 NUT, CLINCH: 79NCFMA2-62 (72962)	12		5 35				1	1	1	59	40		
MD		A160 PLATE: 7845-311 (11871)	1		1										
MD		A161 BRACKET: 7845-313 (11871)	1		1										
MD		A162 BRACKET: 7845-313-1 (11871)	1		1										
PH	5310-027-7247	A163 NUT, CLINCH SAME AS (A159)	REF		7										
PH	5940-106-5932	A164 TERMINAL: SAME AS (A157)	REF		2										
POS		164A BOARD ASSY: 7845-316 (11871)	1		1	*	*	1	*	*	1	8	3		

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X1H		A165 CIRCUIT BOARD: 7845-315 (11871)	1		1										
X1H		A166 CIRCUIT BOARD: 7845-315-1 (11871)	1		1										
MD		A167 STIFFENER: 7845-317 (11871)	2		2										
X1H		A168 RIVET: MS20470A2-4 (96906)	4		4										
PH	5945-904-8319	A169 RELAY: M5757-9-003 (81349)	2		2 6				*	1	1	13	6		
PH		A170 RELAY: 5605-182-9 3SAH13262A2 (01527)	9		9 27				1	1	1	46	30		
PH	5905-468-2727	A171 RESISTOR: RN55C1652D (81349)	1		1 3				*	*	1	8	3		
PH		A172 RESISTOR: RN55C3322D (81349)	1		1 3				*	*	1	8	3		
PH	5905-471-2103	A173 RESISTOR: RN55C3922D (81349)	1		1 3				*	*	1	8	3		
PH		A174 RESISTOR: RN55C6042D (81349)	1		1 3				*	*	1	8	3		
PH		A175 RESISTOR: RN55C6652D (81349)	1		1 3				*	*	1	8	3		
PH		A176 RESISTOR: RN55C7772D (81349)	1		1 3				*	*	1	8	3		
PH	5905-905-2782	A177 RESISTOR: RN60C1153D (81349)	1		1 3				*	*	1	8	3		
PH		A178 RESISTOR: RN60C1203D (81349)	1		1 3				*	*	1	8	3		
PH		A179 RESISTOR: RN60C1323D (81349)	1		1 3				*	*	1	8	3		
PH	5905-914-6474	A180 RESISTOR: RN60C1423D (81349)	1		1 3				*	*	1	8	3		
PH	5905-935-8526	A181 RESISTOR: RN60C1673D (81349)	2		2 6				*	1	1	13	6		
PH		A182 RESISTOR: RN60C2583D (81349)	1		1 3				*	*	1	8	3		
PH	5905-948-2141	A183 RESISTOR: RN60C2843D (81349)	1		1 3				*	*	1	8	3		
PH	5905-998-9179	A184 RESISTOR: RN60C3363D (81349)	1		1 3				*	*	1	8	3		
PH	5905-923-3608	A185 RESISTOR: RN60C4933D (81349)	1		1 3				*	*	1	8	3		
PH		A186 RESISTOR: RN65C5173D (81349)	1		1 3				*	*	1	8	3		
PH		A187 RESISTOR: RN65C5693D (81349)	1		1 3				*	*	1	8	3		
PH	5905-468-2728	A188 RESISTOR: RN65C7062D (81349)	1		1 3				*	*	1	8	3		
PH		A189 RESISTOR: RN65C7153D (81349)	1		1 3				*	*	1	8	3		
PH	5961-087-6047	A190 SEMICONDUCTOR: 1N645 (81349)	21		11 60				1	1	2	71	50		
PH	5970-929-5845	A191 SPACER: RCRP800090-1A (19080)	2		2 6				*	1	1	13	6		
PH		A192 SPACER: 10273DAP (07047)	9		9 25				1	1	1	40	25		

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MD		A193 PLATE: 7845-319 (11871)	1		1										
GOS		A194 TRAY ASSY: 7845-320 (11871)	1		1 3				*	*	1	8	3		
MD		A195 CLAMP ASSY: 7845-314 (11871)	1		1										
MD		A196 TRAY: 7855-314-1 (11871)	1		1										
PH	5340-766-0326	A197 CLAMP ASSY: NAS573-4 (80205)	2		2 6				*	1	1	13	6		
PH	5320-256-1946	A198 RIVET: MS20426A6-6 (96906)	4		4 12				1	1	1	22	12		
PH	5340-721-7418	A199 SHOCK MOUNT: 2704-301-11 B44EB4 (81860)	4		4 12				1	1	1	22	12		
MD		A200 BLOCK: 7845-324 (11871)	2		2										
PH		A201 SCREW: CAV73-4-5G (11871)	4		4 12				1	1	1	22	12		
MD		A202 PIN: 7845-323 (11871)	2		2										
PH	5305-857-6832	A203 SCREW: MS24693S49 (96906)	4		4 12				1	1	1	22	12		
PH		A204 STRAP GROUNDING: 5525-144 (11871)	2		2 6				*	1	1	13	6		
MD		A205 GUIDE ASSY: 7845-321 (11871)	1		1										
MD		A206 BRACKET: 7845-321-1 (11871)	1		1										
PH	5320-286-4209	A207 RIVET: MS20426A3-2 (96906)	12		12 30				1	1	1	46	30		
PH	5320-165-8768	A208 RIVET: SAME AS (A154)	REF		2										
PH	5325-355-8963	A209 SPRING: SAME AS (A150)	REF		1										
MD		A210 RETAINER: 15B8-3 (18915)	6		6										
MD		A211 COVER: 7845-322 (11871)	1		1										
MD		A212 COVER: 7845-322-1 (11871)	1		1										
PH	5325-291-0364	A213 STUD: AJ4-30 (72794)	3		3 9				*	1	1	18	9		
PH	5325-281-4965	A214 GROMMET: GA4-250 (72794)	3		3				*	11	1	18	9		
MD		A215 PLATE: 7845-318 (11871)	1		1										
PH		A216 WASHER: CAV10-28P (11871)	2		2 6				*	1	1	13	6		
PH	5310-753-4175	A217 WASHER: CAV10-32P (11871)	12		12 30				1	1	1	46	30		
PH	5305-993-9189	A218 SCREW: CAV73-4-4G (11871)	2		2 6				*	1	1	13	6		
PH	5305-576-7272	A219 SCREW: CAV70-6-7P (11871)	8		8 20				1	1	1	33	20		
PH	5305-802-7927	A220 SCREW: CAV70-6-6P (11871)	6		6 15				1	1	1	27	15		

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PH	5305-940-9491	A221 SCREW: CAV73C6-8G (11871)	4		4 12				1	1	1	22	12		
PH		A222 SCREW: CAV70-4-5P (11871)	10		10 30				1	1	1	46	30		
PH	5305-639-8291	A223 SCREW: CAV70-4-9P (11871)	2		2 6				*	1	1	13	6		
PH	5305-655-5991	A224 SCREW: SAME AS (A112)	REF		10										
PH	5305-922-8778	A225 SCREW: MS35275-203 (96906)	14		14 50				1	1	2	71	50		
PH	5305-802-1537	A226 SCREW: CAV70-4-6P (11871)	4		4 12				1	1	1	22	12		
PH	5305-802-1538	A227 SCREW: CAV70-4-7P (11871)	3		3 9				*	1	1	18	9		
PH	5305-054-5651	A228 SCREW: CAV70-4-8P (11871)	6		6 18				1	1	1	33	20		
PH		A229 WASHER: AN935-10 (88044)	4		4 15				1	1	1	27	15		
PH	5975-821-5461	A230 HOOK: NAS622CT2 (80205)	2		2 6				*	1	1	13	6		
PH	5305-076-0213	A231 SCREW: NAS1351C3-10 (80205)	4		4 15				1	1	1	27	15		
PH	5940-615-8958	A232 TERMINAL: 2104-06-02 (78189)	3		3 9				*	1	1	18	9		
PH	5935-820-1547	A233 CONNECTOR: MS3112E22-55S (96906)	1		1 3				*	*	1	8	3		
PH	5935-892-9600	A234 CONNECTOR CAP: MS3181-22C (96906)	1		1 3				*	*	1	8	3		
PH	5940-682-2477	A235 TERMINAL: 2104-04-01 (78189)	2		2 6				*	1	1	13	6		
PH		A236 TERMINAL BOARD: 5124 (23466)	1		1 3				*	*	1	8	3		
PH		A237 TERMINAL BOARD: 5122 (23466)	1		1 3				*	*	1	8	3		
PO	5920-280-4960	A238 FUSE: F02A250V2A (81349)	5		5 50	2	3	6	1	1	2	71	50		
PO	5920-284-6787	A239 FUSE: F02A250V5A (81349)	2		2 20	1	2	3	1	1	1	33	20		
PO	5920-839-4430	A240 FUSE: F03B32V15A (81349)	2		2 20	1	2	3	1	1	1	33	20		
PF	5920-556-0144	A241 FUSEHOLDER: FHN20G (81349)	9		9 30	*	1	1	*	1	1	18	9		
PF	5945-924-9542	A242 RELAY: RY4XX4B3L11 (81349)	3		3 9	*	1	1	*	1	1	18	9		
PH	5961-087-6047	A243 SEMICONDUCTOR: SAME AS (A036)	REF		10										
PH		A244 TERMINAL: 2102-06-02 (78189)	1		1 3				*	*	1	8	3		
PH	5310-080-4503	A245 NUT: SAME AS (A028)	REF		16										
PH	5310-822-3840	A246 NUT: SAME AS (A109)	REF		14										
PH	5310-614-3500	A247 NUT: SAME AS (A089)	REF		27										
PH		A248 CONNECTOR: 7845-326-144 KPT02E24A57SW (71468)	1		1 3				*	*	1	8	3		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(6) (b) 21-50	(6) (c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(7) (b) 21-50	(7) (c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(10) (b) ITEM NO. OR REFERENCE DESIGNATION
PH		A249 CONNECTOR: 7845-325-122 KPT02E24A57D (71468)	1		1				*	*	1	8	3		
PH		A250 CONNECTOR: 600-13PCSCGD36 (95238)	1		1 5				*	1	1	12	5		
MD		A251 HANDLE: 1012-14 (15849)	2		2				*	1	1	12	5		
MD		A252 FERRULE: 900-14 (15849)	4		4										
MD		A253 WIRING DIAGRAM: 7845-302 (11871)	1		1										
PF	5915-930-5322	A254 FILTER: 7438-735-46 1200-027 (72982)	3		3 9	*	1	1	*	1	1	18	9		
MD		A255 BRACKET: 7845-328 (11871)	2		2										
MD		A256 BRACKET: 7845-329 (11871)	1		1										
PH	5310-638-9857	A257 WASHER: AN960C6L (88044)	2		2 6				*	1	1	13	6		

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REFERENCE NUMBER & MFR. CODE	USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30-DAY DS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(7) 30-DAY GS MAINT ALLOWANCE (a) 1-20	(b) 21-50	(c) 51-100	(8) 1 YR ALW PER EQUIP CNTGCY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATIONS (a) FIG NO.	(b) ITEM NO. OR REFERENCE DESIGNATION
	6720-087-3151	CAMERA, STILL PICTURE KA-76A (REFER TO TM 11-6720-236-35)													
	6760-798-0794	LENS CONES, CAMERA, AERIAL RECONNAISSANCE LA-370A, LA-371A, AND LA-372A (REFER TO TM 11-6720-236-35)													
	6760-910-3802	FLASHER SYSTEM, PHOTOGRAPHIC LS-59A (REFER TO TM 11-6760-228-35)													
	6720-730-6780	OBLIQUE SIGHT LA-162A (REFER TO TM 11-6720-212-25P)													
	6720-730-6776	OBLIQUE SIGHT LA-163A (REFER TO TM 11-6720-212-25P)													

INDEX

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
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Chief of Staff.

Official:
VERNE L. BOWERS
Major General, United States Army,
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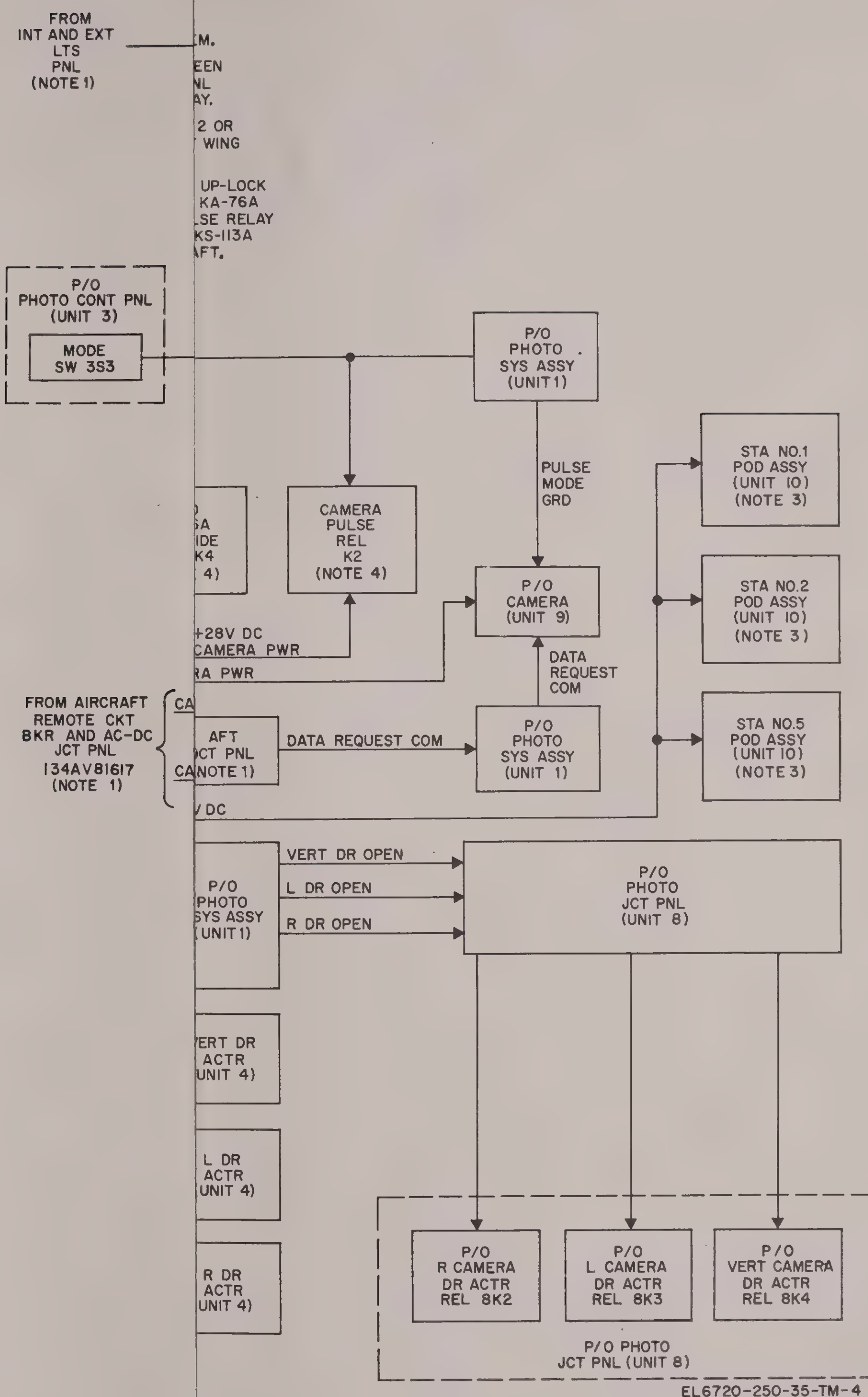

FROM INT AND EXT LTS PNL (NOTE 1)
M.
EEN
NL
AY.
2 OR
WING
UP-LOCK
KA-76A
SE RELAY
KS-113A
FT.
P/O PHOTO CONT PNL (UNIT 3)
MODE SW 3S3
P/O PHOTO SYS ASSY (UNIT 1)
CAMERA PULSE REL K2 (NOTE 4)
PULSE MODE GRD
STA NO.1 POD ASSY (UNIT 10) (NOTE 3)
STA NO.2 POD ASSY (UNIT 10) (NOTE 3)
STA NO.5 POD ASSY (UNIT 10) (NOTE 3)
P/O CAMERA (UNIT 9)
+28V DC
CAMERA PWR
RA PWR
DATA REQUEST COM
FROM AIRCRAFT REMOTE CKT BKR AND AC-DC JCT PNL 134AV81617 (NOTE 1)
AFT JCT PNL (NOTE 1)
DATA REQUEST COM
P/O PHOTO SYS ASSY (UNIT 1)
V DC
P/O PHOTO SYS ASSY (UNIT 1)
VERT DR OPEN
L DR OPEN
R DR OPEN
P/O PHOTO JCT PNL (UNIT 8)
VERT DR ACTR (UNIT 4)
L DR ACTR (UNIT 4)
R DR ACTR (UNIT 4)
P/O R CAMERA DR ACTR REL 8K2
P/O L CAMERA DR ACTR REL 8K3
P/O VERT CAMERA DR ACTR REL 8K4
P/O PHOTO JCT PNL (UNIT 8)
EL6720-250-35-TM-4

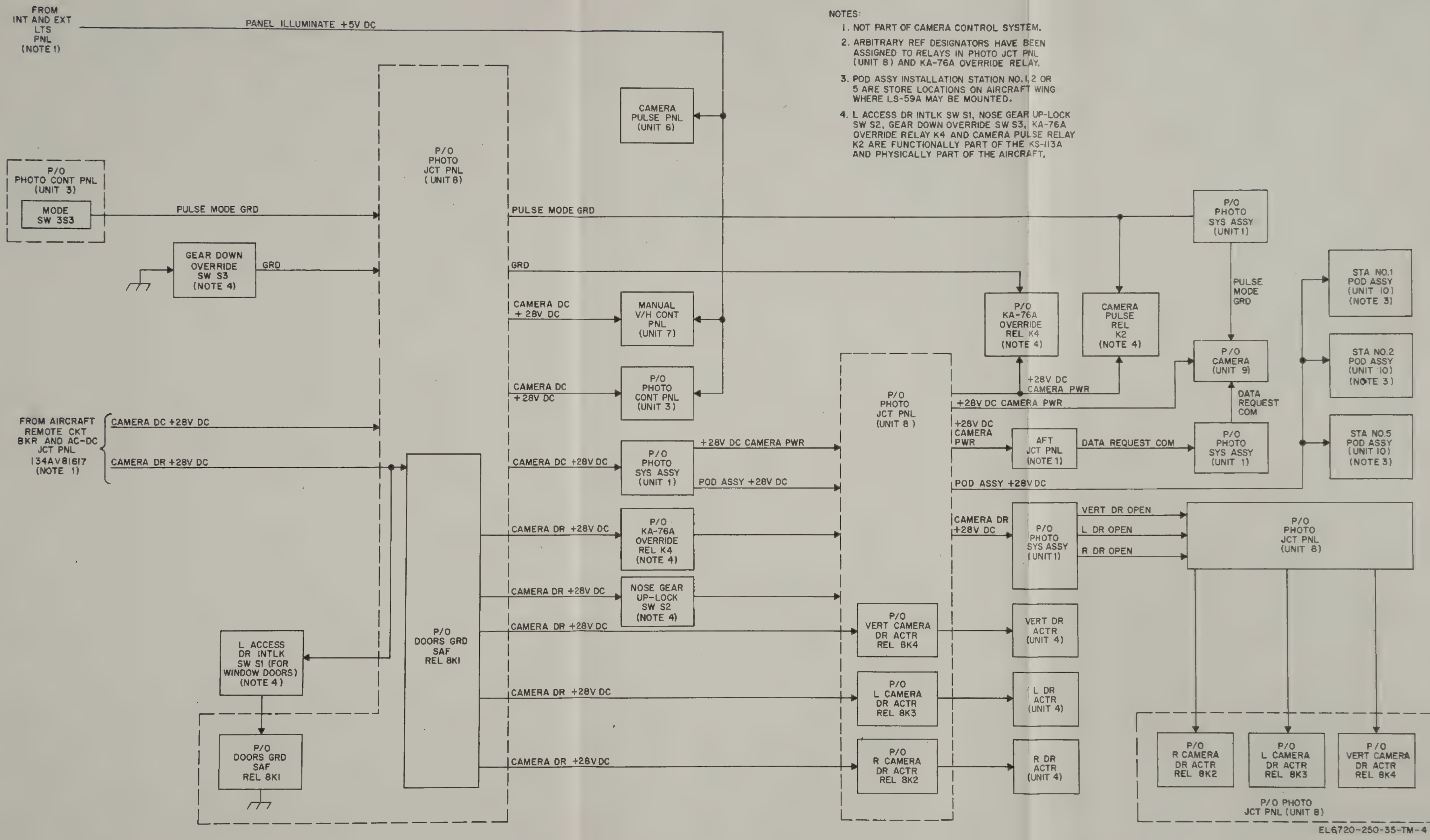
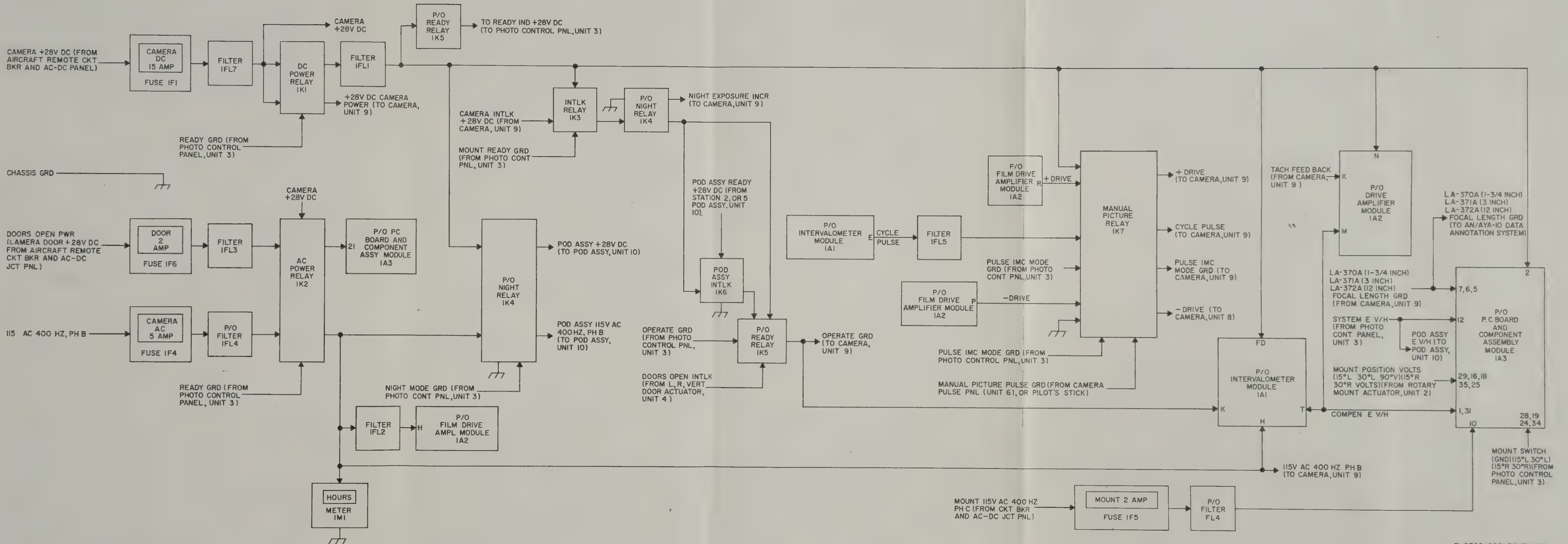
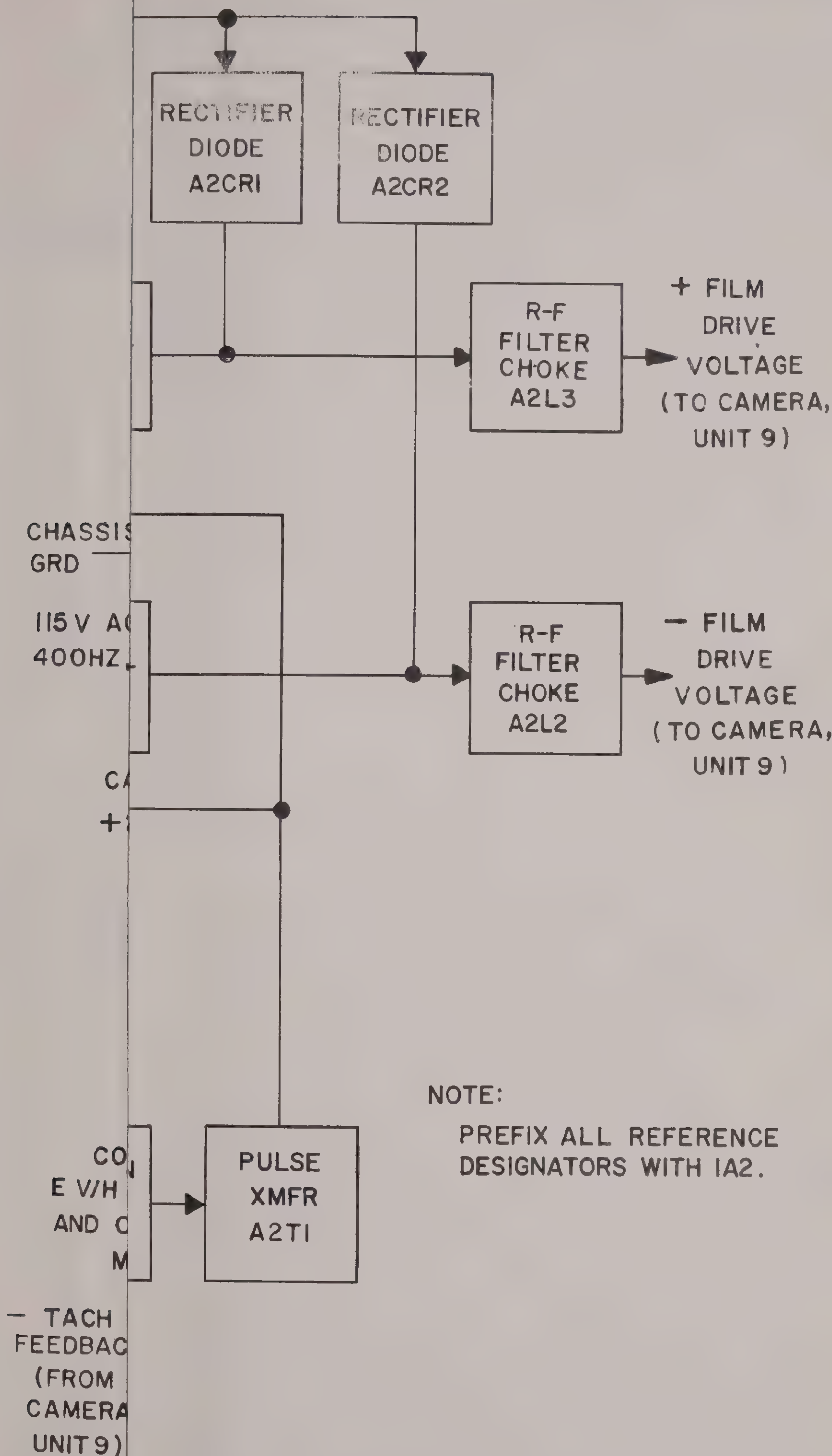


Figure 2-4. Primary dc power circuit, block diagram.



EL6720-250-35-TM-22

Figure 2-20. Photo system assembly, block diagram.



NOTE:

PREFIX ALL REFERENCE DESIGNATORS WITH 1A2.

EL 6720-250-35-TM-31

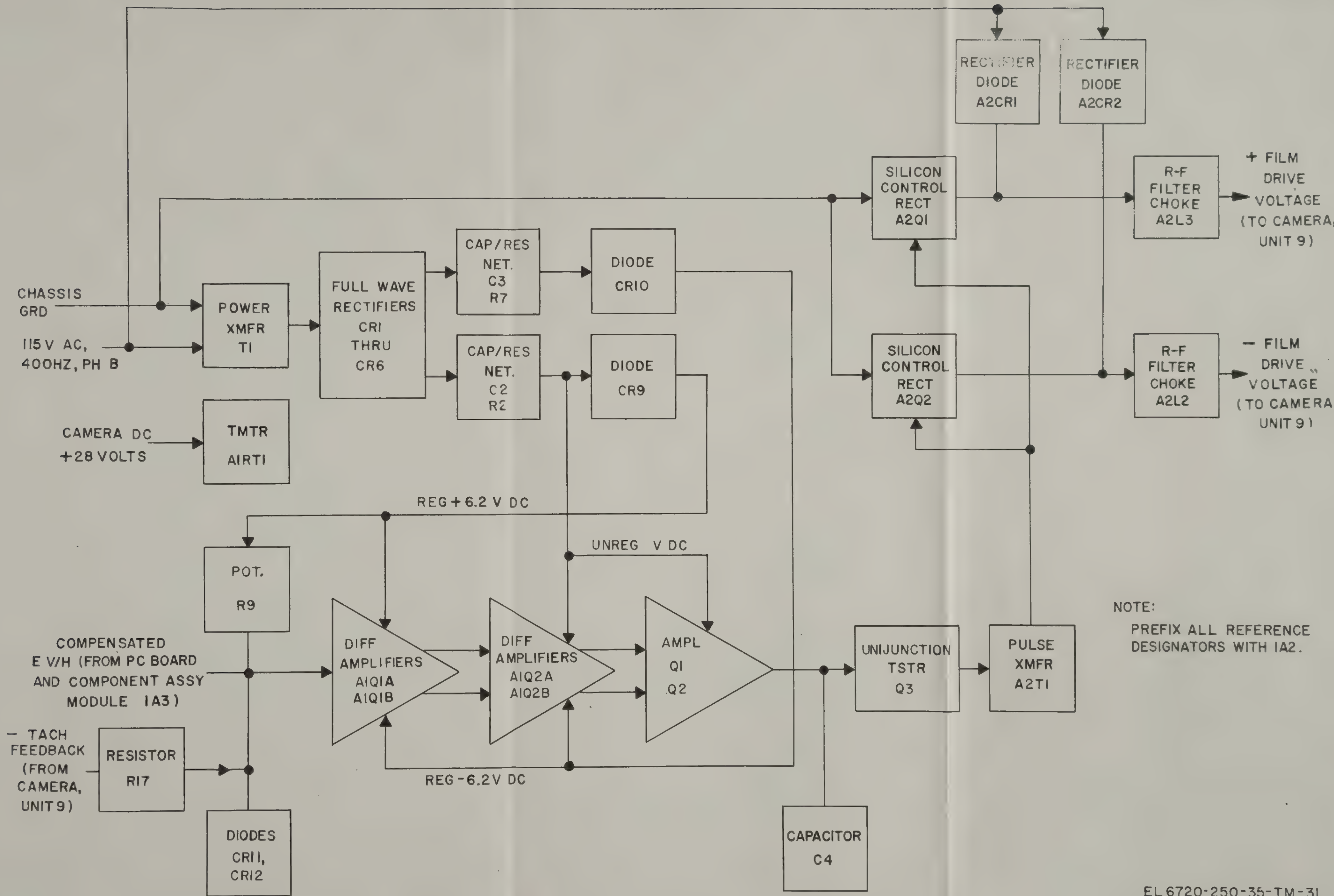
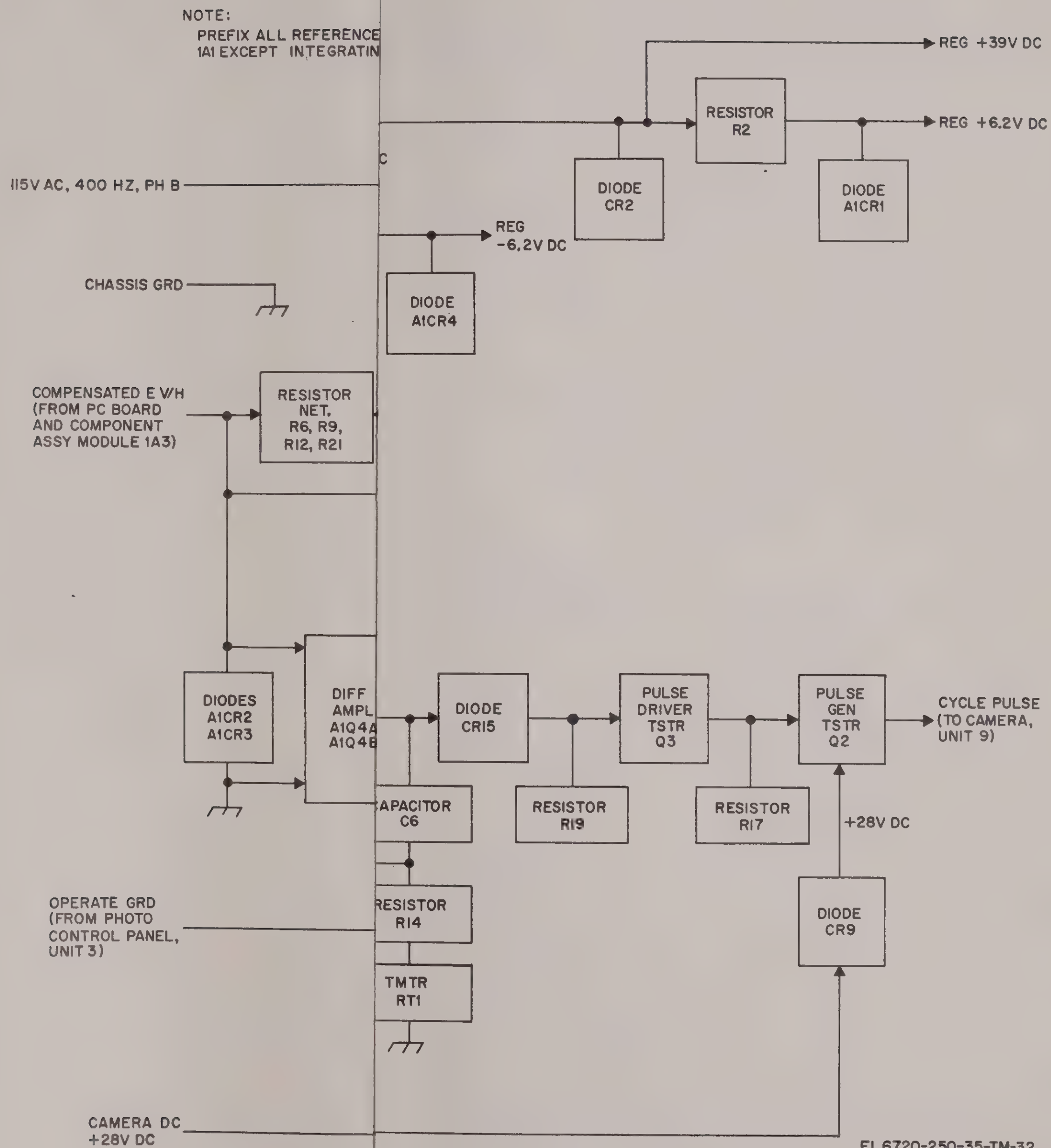


Figure 2-29. Film drive amplifier module 1A2, block diagram.



EL6720-250-35-TM-32

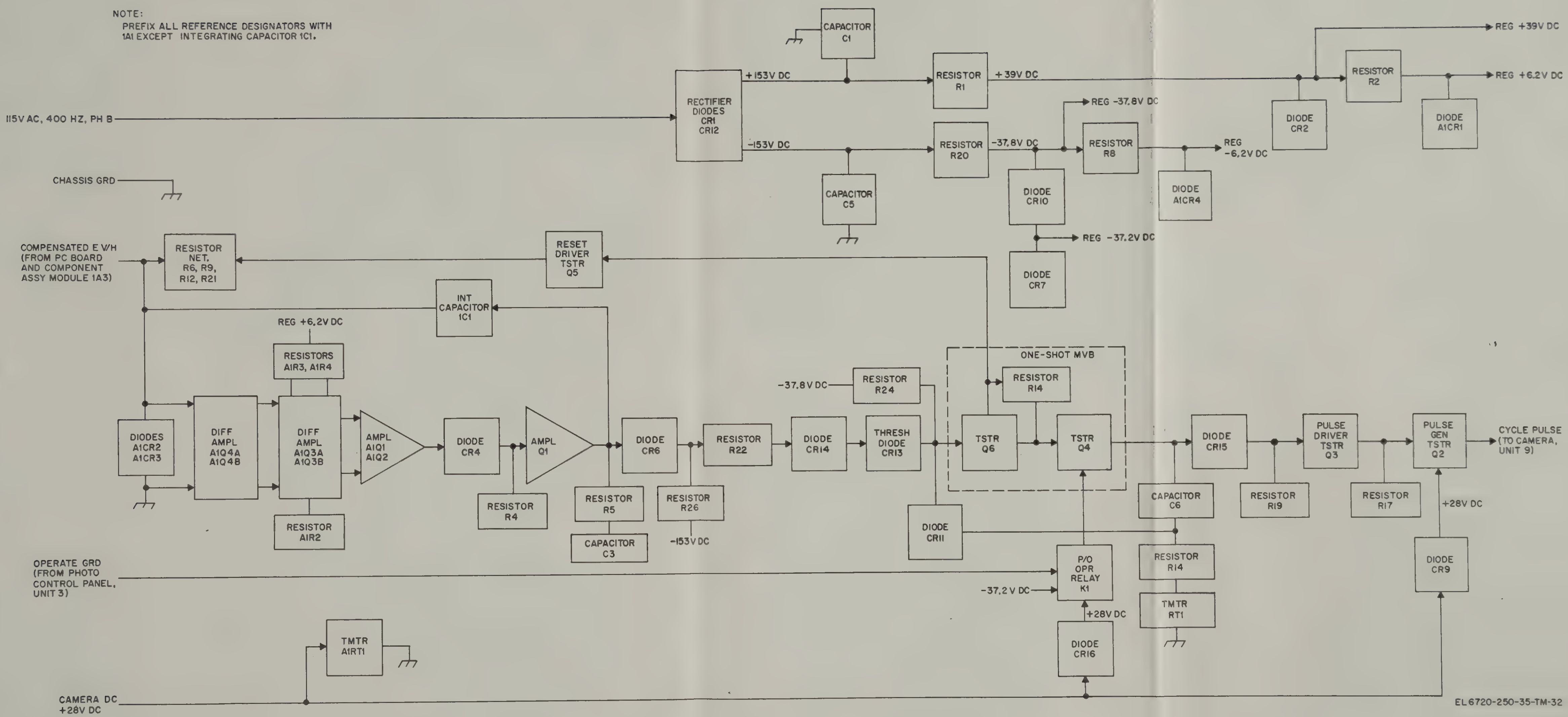
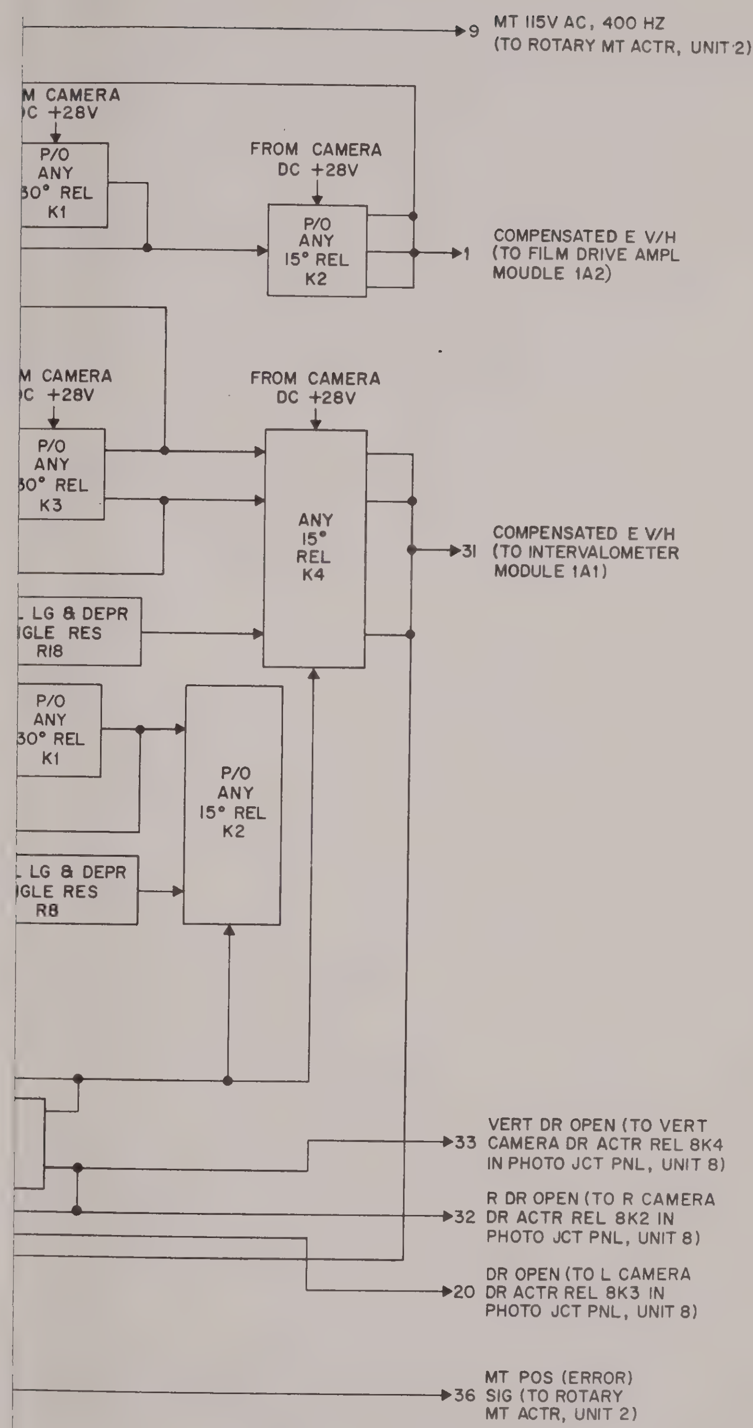


Figure 2-30. Intervalometer module 1A1, block diagram.



EL6720-250-35-TM-33

component assembly
ram.

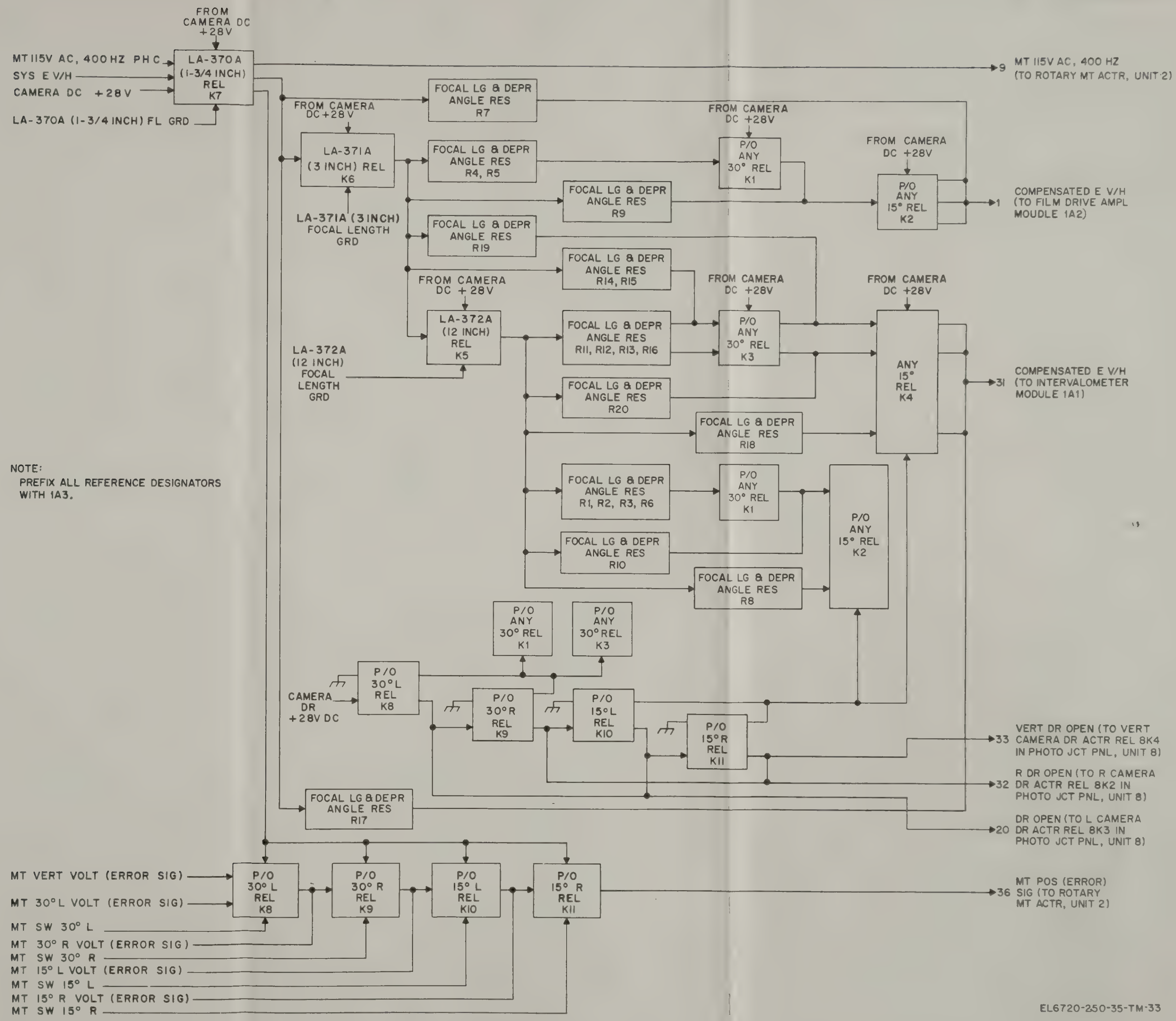
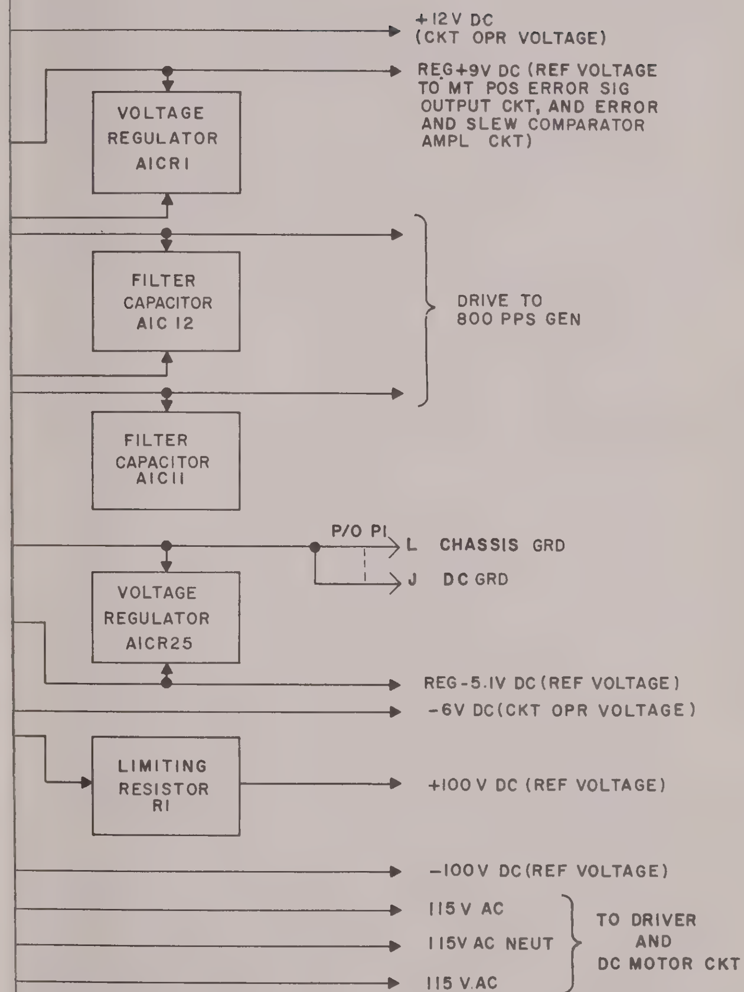


Figure 2-31. Printed circuit board and component assembly module 1A3, block diagram.



EL 6720-250-35-TM-18

ram.

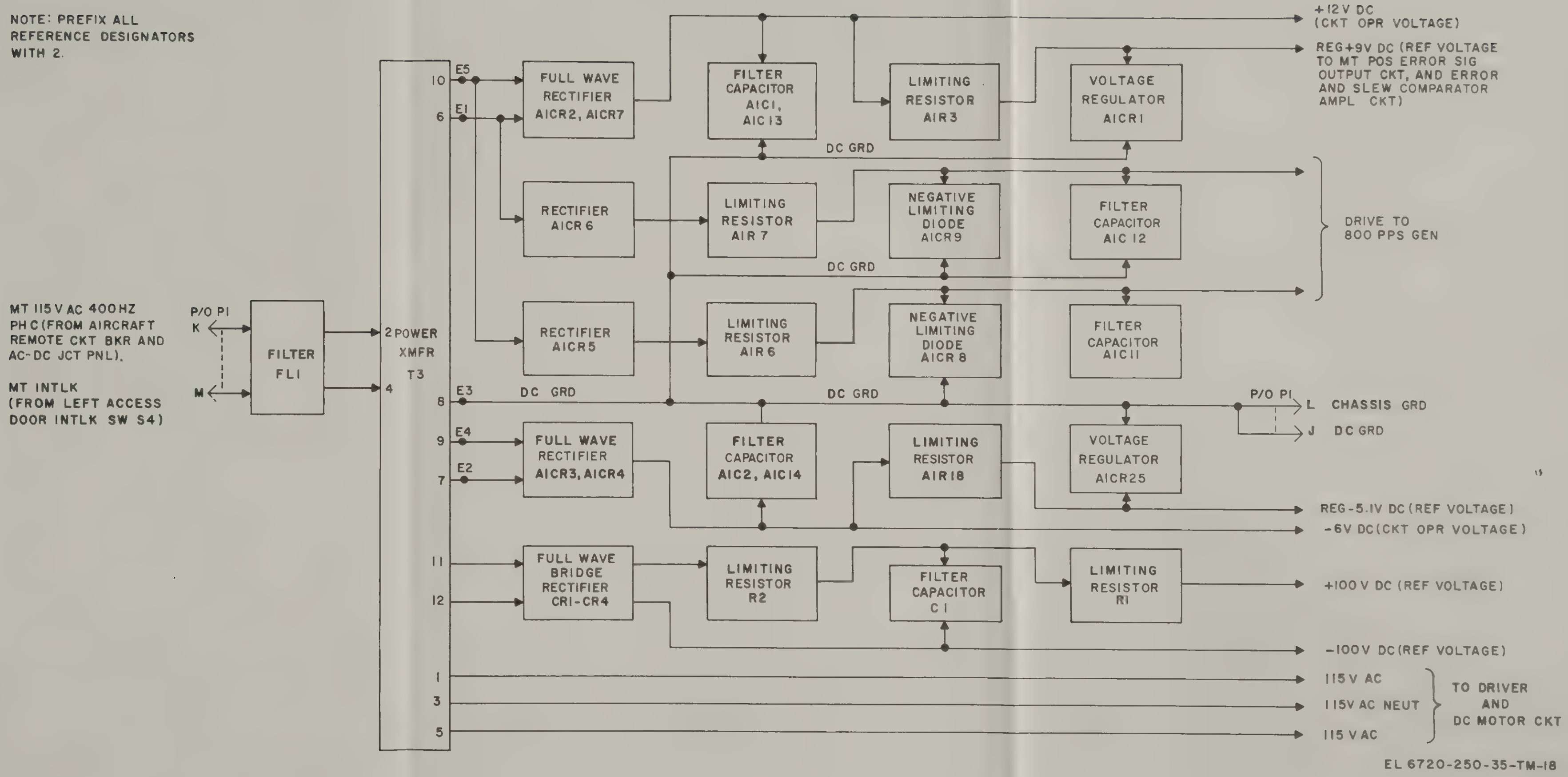
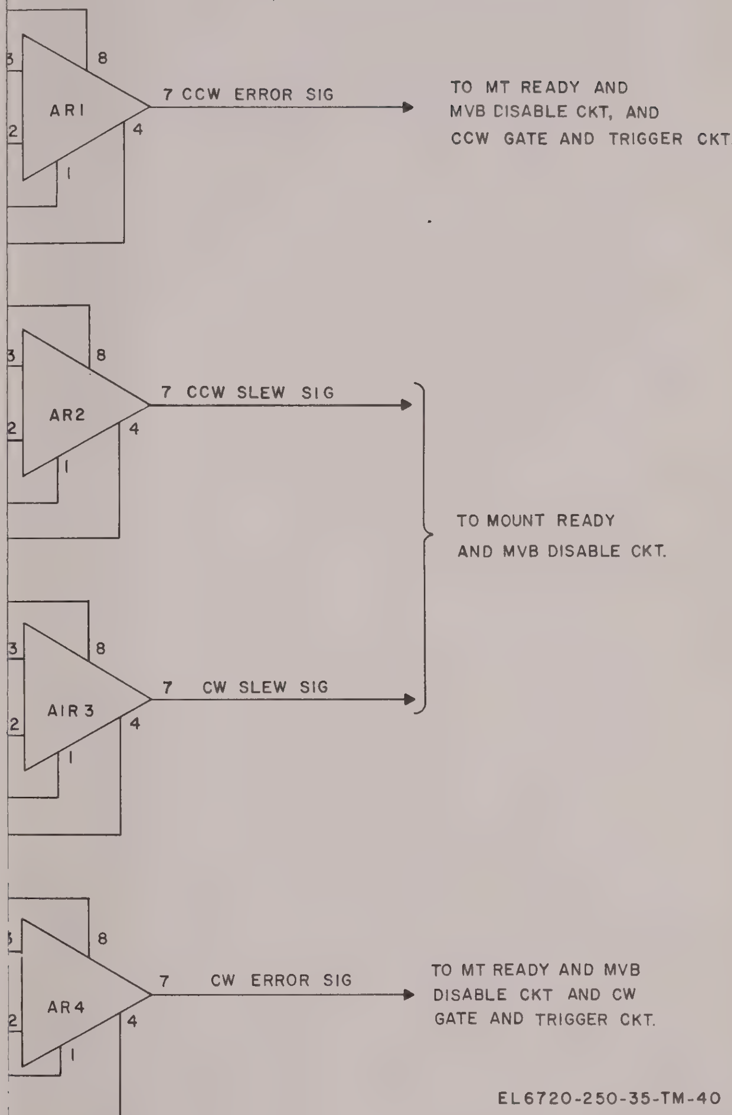


Figure 2-32. Power and distribution circuit, block diagram.



uit, simplified

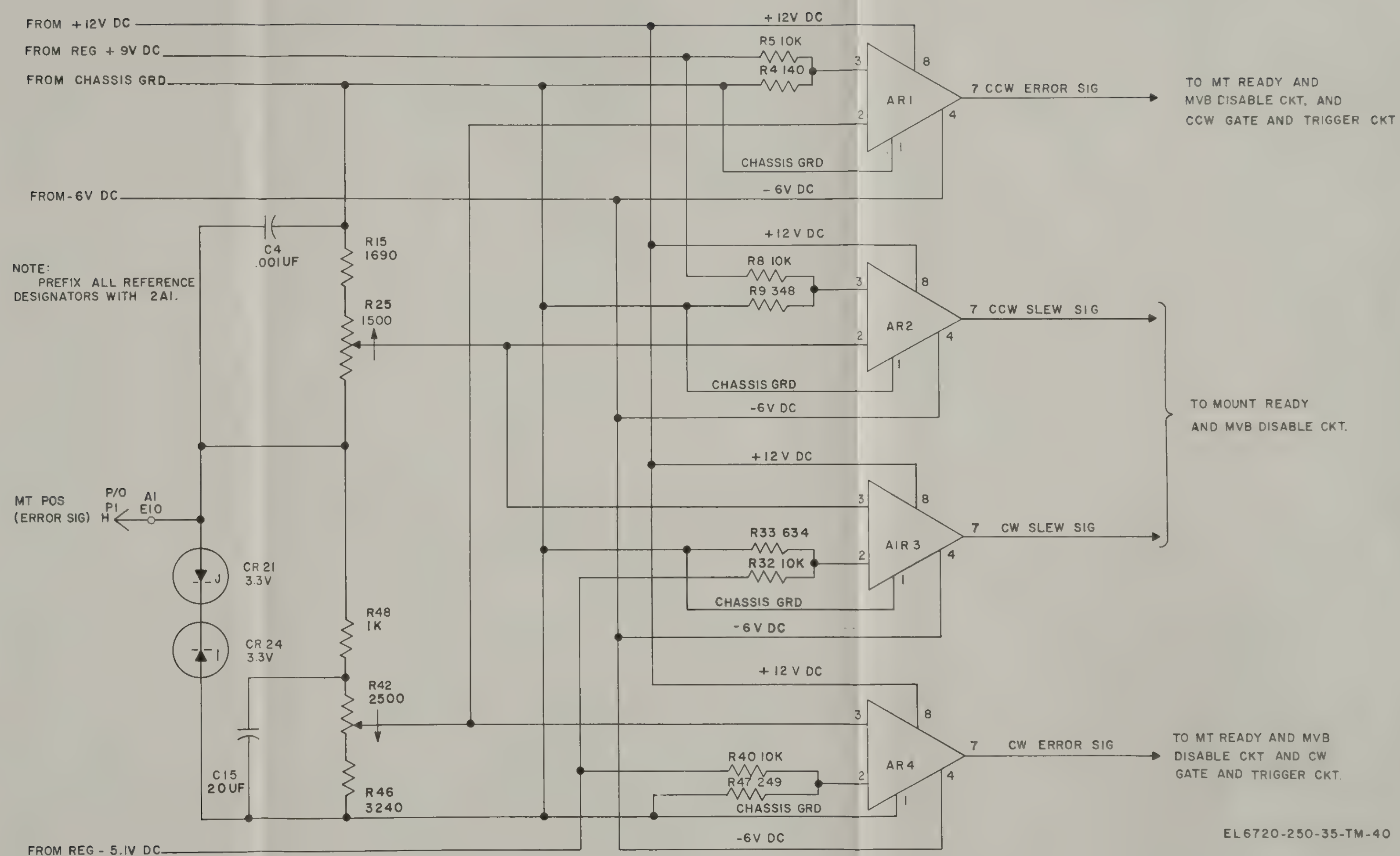


Figure 2-34. Error and slew comparator amplifier circuit, simplified schematic diagram.

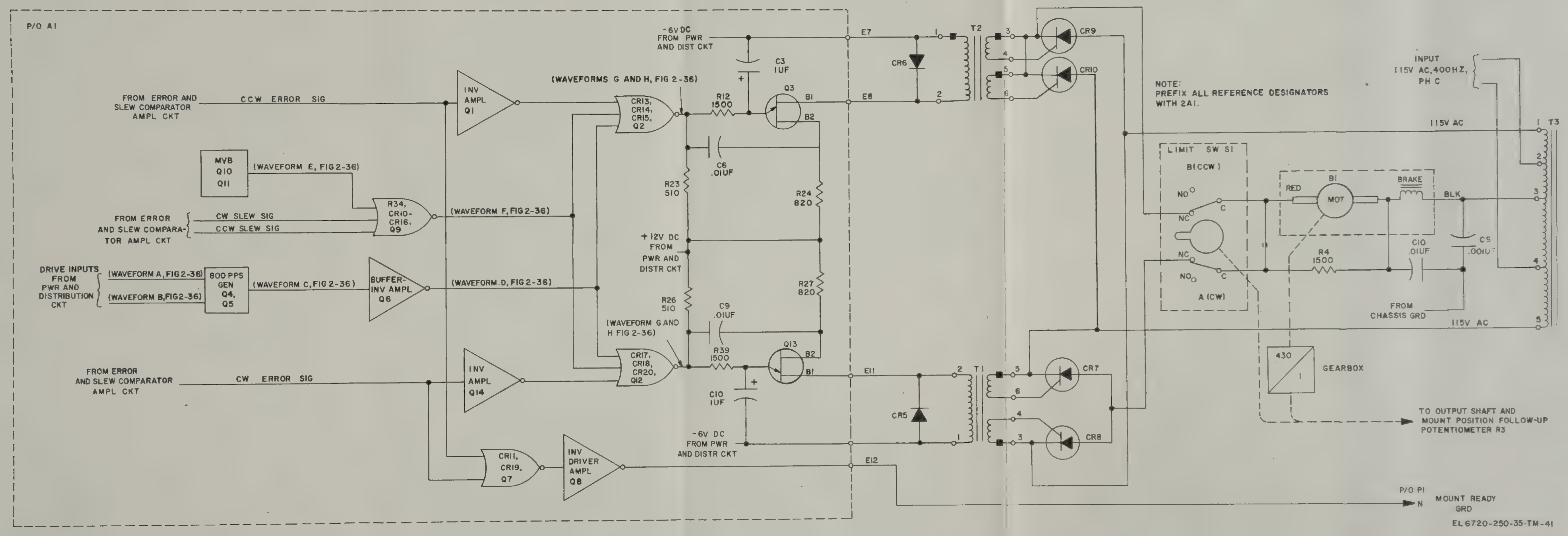


Figure 2-35. Dc motor control and positioning and mount ready circuits, simplified schematic diagram.

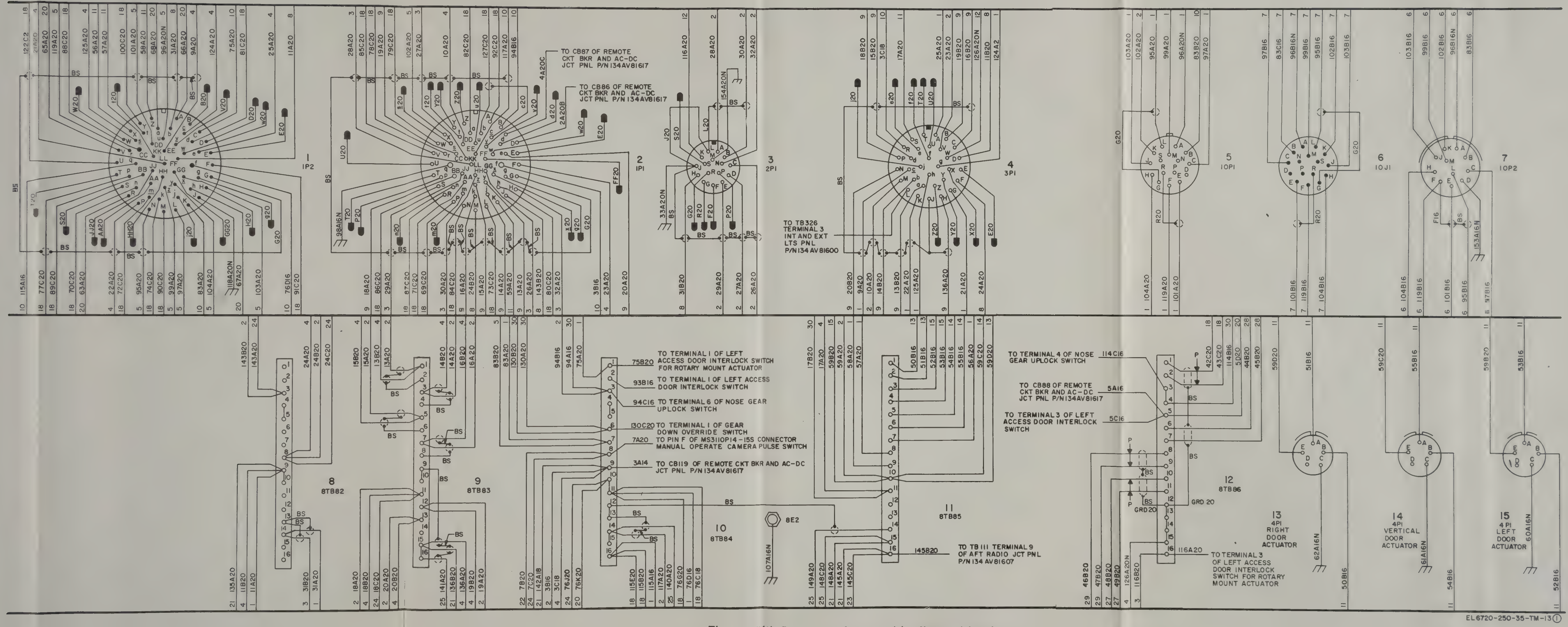
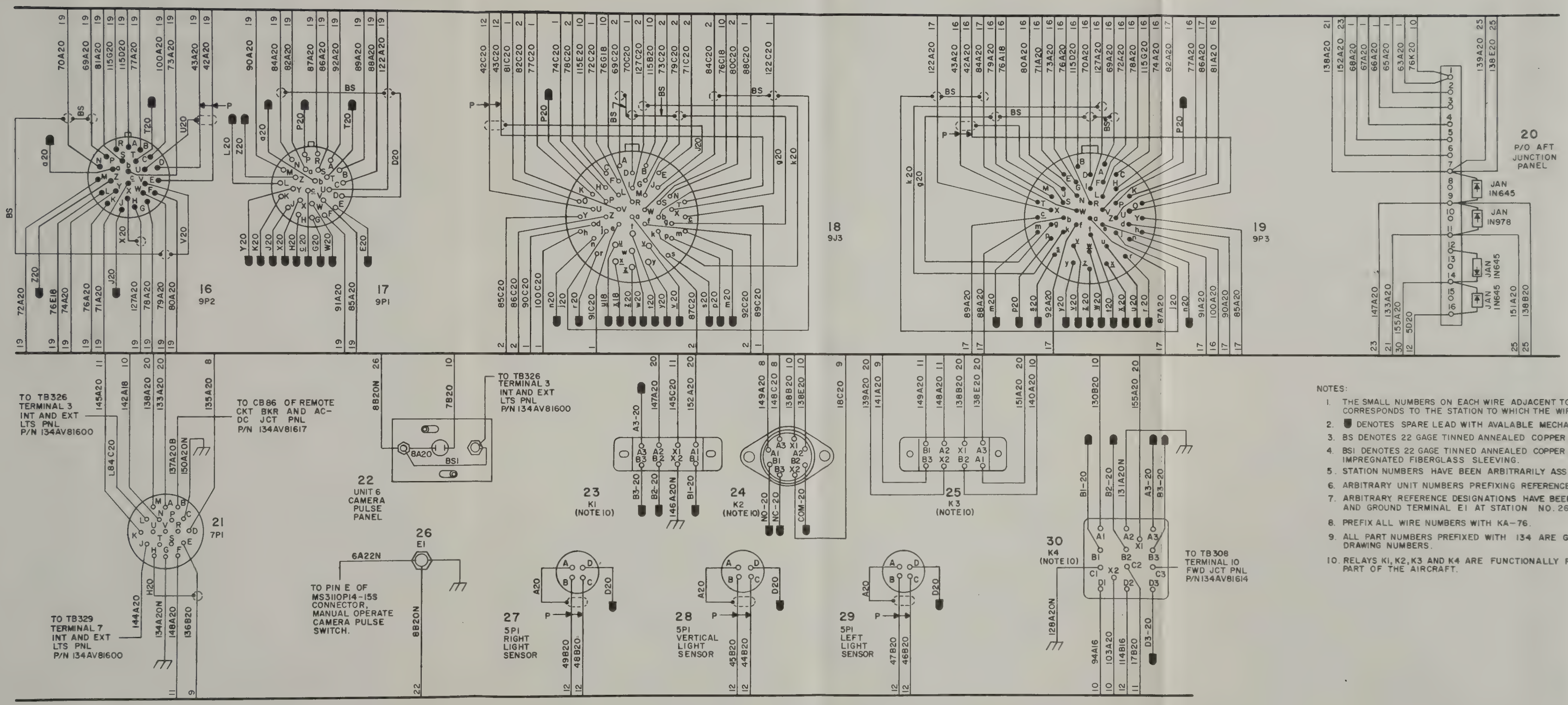


Figure 2-37(1). Camera control system, wiring diagram (aircraft No. 68-16990-01 and subsequent) (sheet 1 of 2).

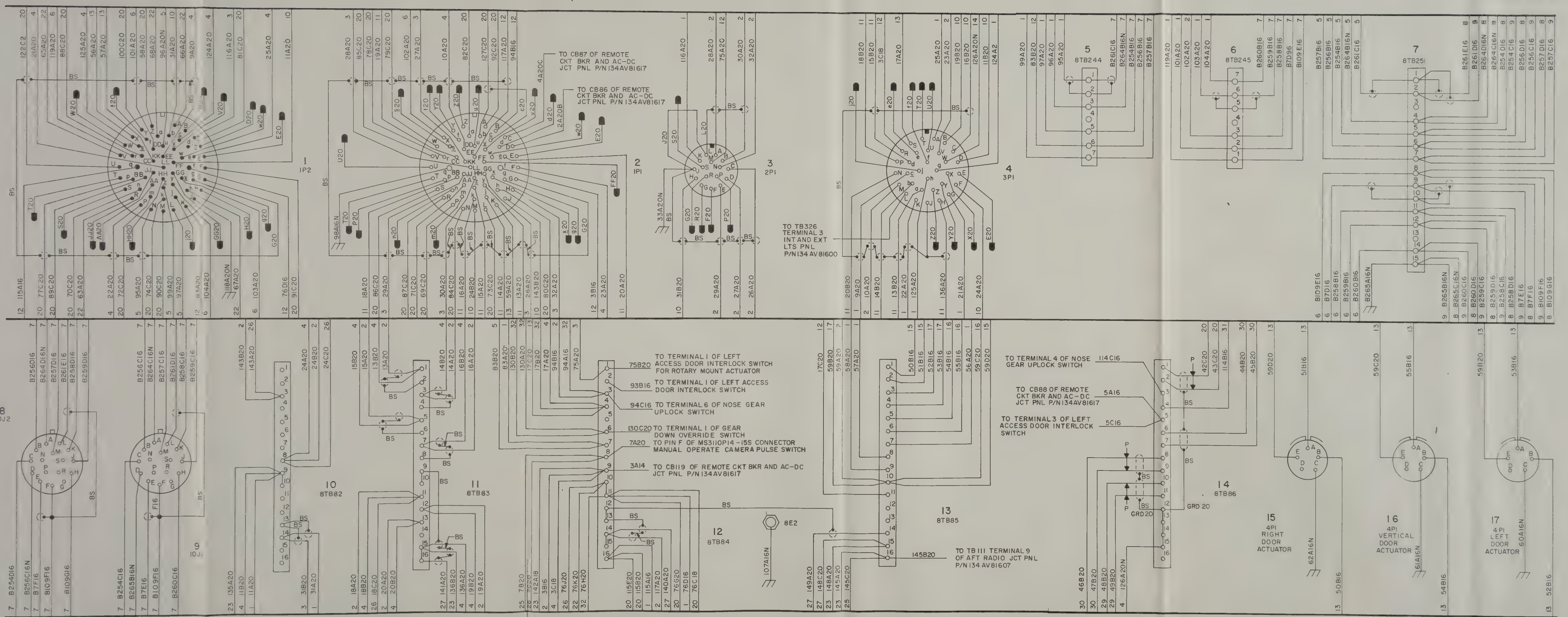


NOTES:

1. THE SMALL NUMBERS ON EACH WIRE ADJACENT TO THE COMMON OR BASE LINE CORRESPONDS TO THE STATION TO WHICH THE WIRE RUNS.
2. ▮ DENOTES SPARE LEAD WITH AVALABLE MECHANICAL SPLICE.
3. BS DENOTES 22 GAGE TINNED ANNEALED COPPER WIRE.
4. BS1 DENOTES 22 GAGE TINNED ANNEALED COPPER WIRE WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.
5. STATION NUMBERS HAVE BEEN ARBITRARILY ASSIGNED.
6. ARBITRARY UNIT NUMBERS PREFIXING REFERENCE DESIGNATIONS HAVE BEEN ASSIGNED.
7. ARBITRARY REFERENCE DESIGNATIONS HAVE BEEN ASSIGNED FOR UNITS 9 AND 10 AND GROUND TERMINAL E1 AT STATION NO. 26.
8. PREFIX ALL WIRE NUMBERS WITH KA-76.
9. ALL PART NUMBERS PREFIXED WITH 134 ARE GRUMMAN AEROSPACE CORPORATION DRAWING NUMBERS.
10. RELAYS K1, K2, K3 AND K4 ARE FUNCTIONALLY PART OF KS-113A AND PHYSICALLY PART OF THE AIRCRAFT.

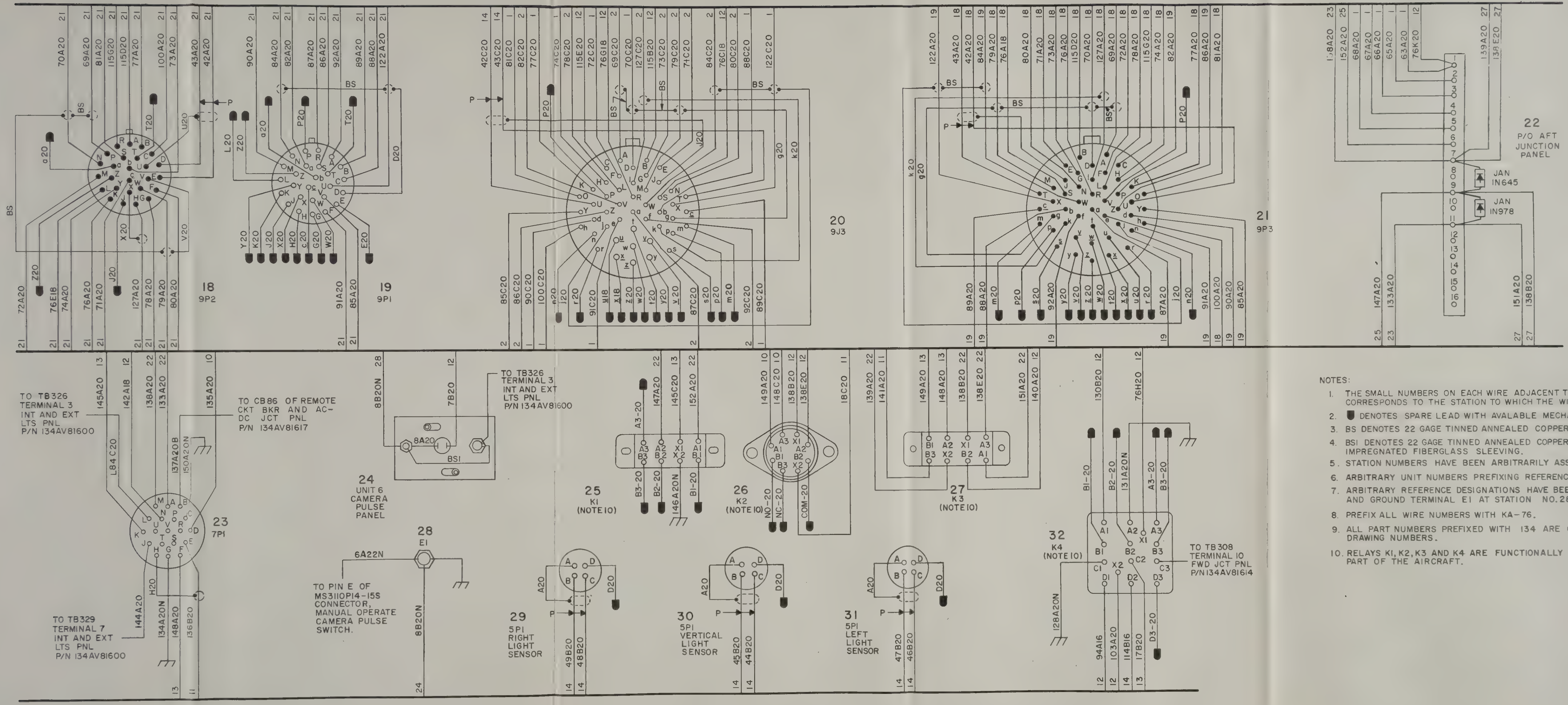
EL6720-250-35-TM-13 (2)

Figure 2-37(2). Camera control system, wiring diagram (aircraft No. 68-16990-01 and subsequent) (sheet 2 of 2).



EL6720-250-35-TM-107(1)

Figure 2-38(1). Camera control system, wiring diagram (aircraft Nos. 67-18898N, 67-18899N, 67-18902N, and 67-18905N) (sheet 1 of 2).



NOTES:

1. THE SMALL NUMBERS ON EACH WIRE ADJACENT TO THE COMMON OR BASE LINE CORRESPONDS TO THE STATION TO WHICH THE WIRE RUNS.
2. ▼ DENOTES SPARE LEAD WITH AVALABLE MECHANICAL SPLICE.
3. BS DENOTES 22 GAGE TINNED ANNEALED COPPER WIRE.
4. BSI DENOTES 22 GAGE TINNED ANNEALED COPPER WIRE WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.
5. STATION NUMBERS HAVE BEEN ARBITRARILY ASSIGNED.
6. ARBITRARY UNIT NUMBERS PREFIXING REFERENCE DESIGNATIONS HAVE BEEN ASSIGNED.
7. ARBITRARY REFERENCE DESIGNATIONS HAVE BEEN ASSIGNED FOR UNITS 9 AND 10 AND GROUND TERMINAL E1 AT STATION NO. 28.
8. PREFIX ALL WIRE NUMBERS WITH KA-76.
9. ALL PART NUMBERS PREFIXED WITH 134 ARE GRUMMAN AEROSPACE CORPORATION DRAWING NUMBERS.
10. RELAYS K1, K2, K3 AND K4 ARE FUNCTIONALLY PART OF KS-113A AND PHYSICALLY PART OF THE AIRCRAFT.

Figure 2-38(2). Camera control system, wiring diagram (aircraft Nos. 67-18898N, 67-18899N, 67-18902N, and 67-18905N) (sheet 2 of 2).

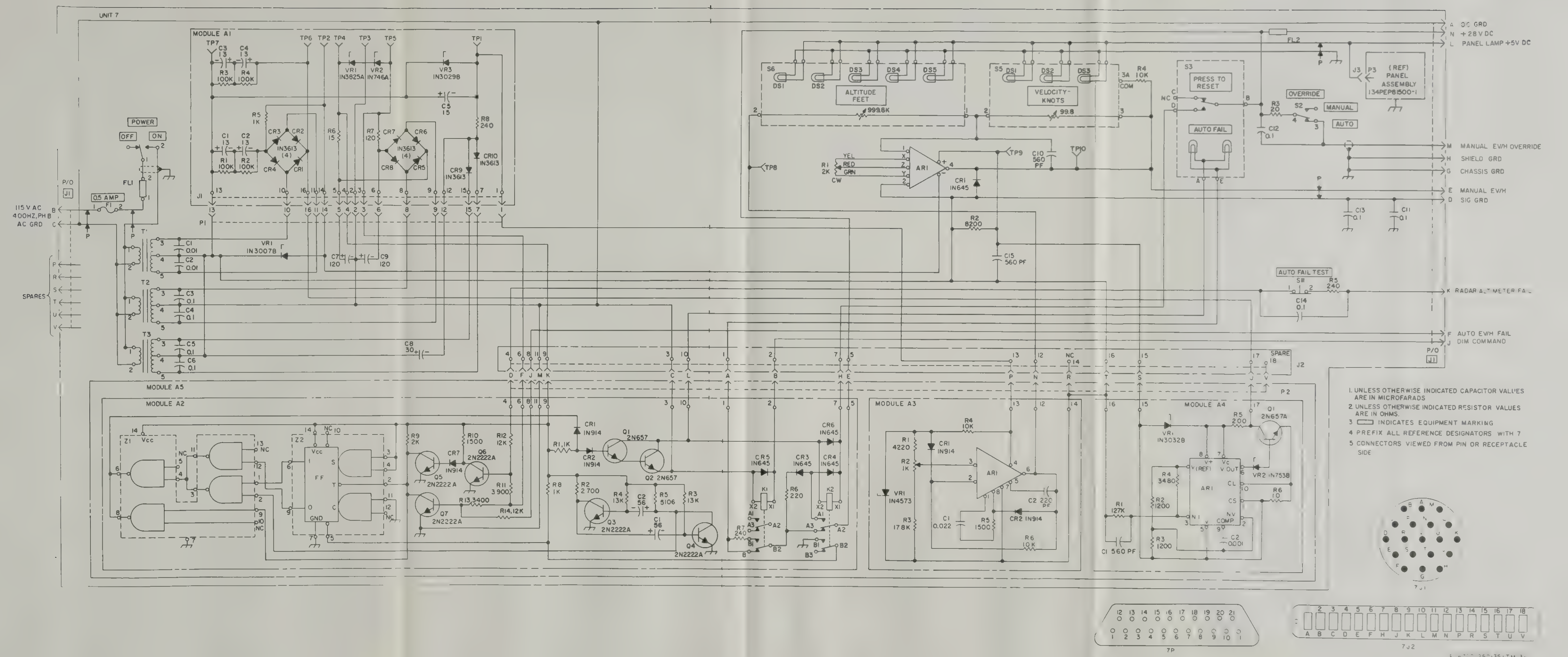
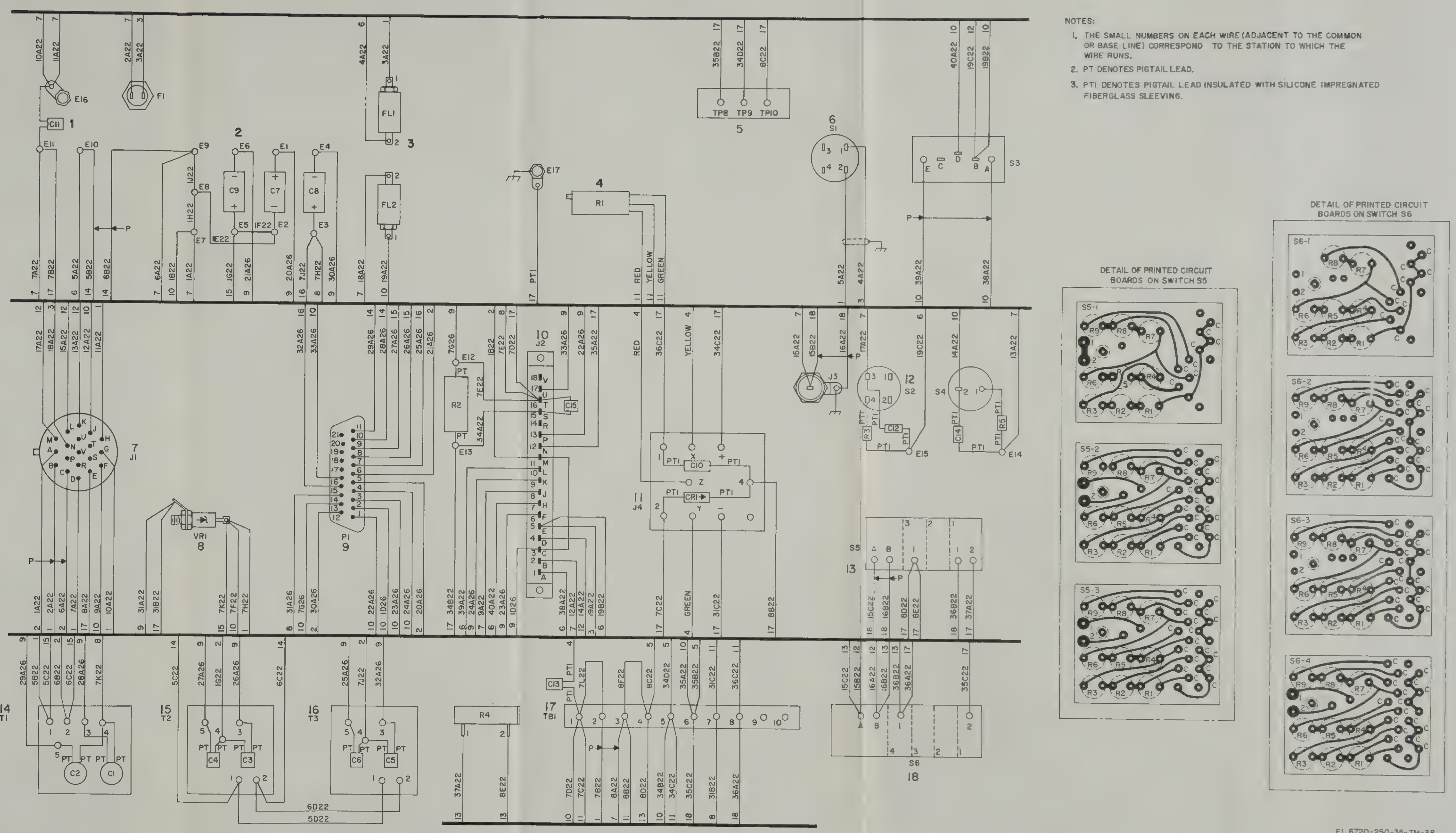


Figure 3-2. Manual V/H control panel, schematic diagram.

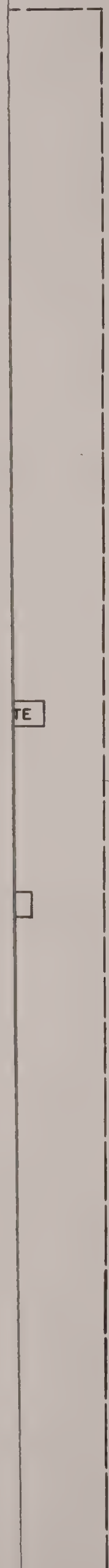
NOTES:

1. THE SMALL NUMBERS ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPOND TO THE STATION TO WHICH THE WIRE RUNS.
2. PT DENOTES PIGTAIL LEAD.
3. PTI DENOTES PIGTAIL LEAD INSULATED WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.



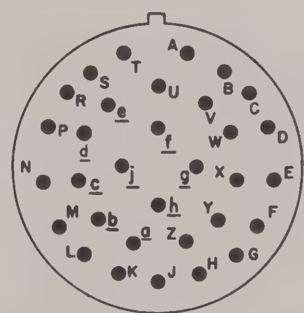
EL 6720-250-35-TM-38

Figure 3-3. Manual V/H control panel, wiring diagram.



NOTES:

1. ▭ INDICATES EQUIPMENT MARKING.
2. PREFIX ALL REFERENCE DESIGNATIONS WITH 3.
3. ARBITRARY NUMBERS HAVE BEEN ASSIGNED TO SWITCHES.
4. CONNECTORS VIEWED FROM PIN OR RECEPTACLE SIDE.



J1

EL 6720-250-35-TM-46

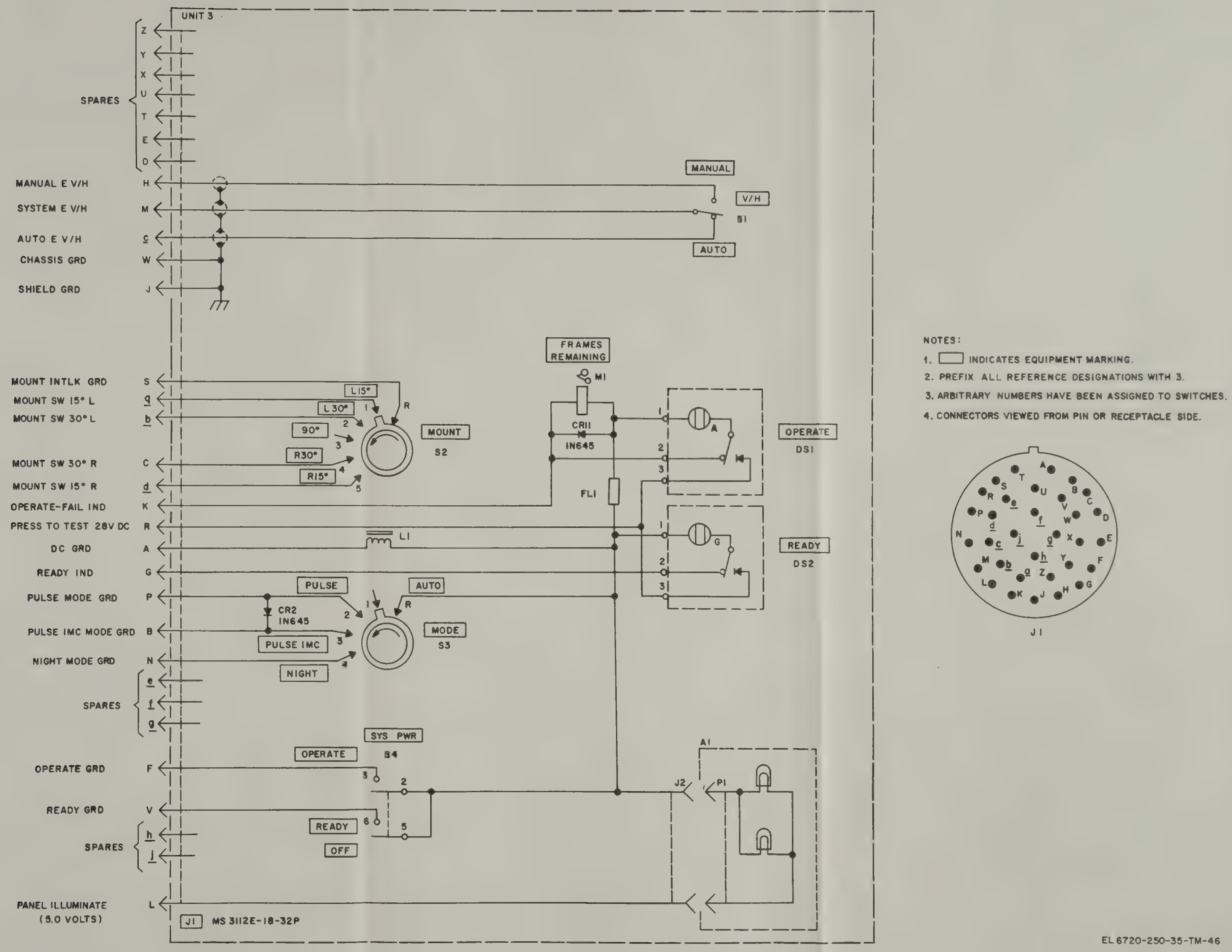


Figure 3-7. Photo control panel, schematic diagram.

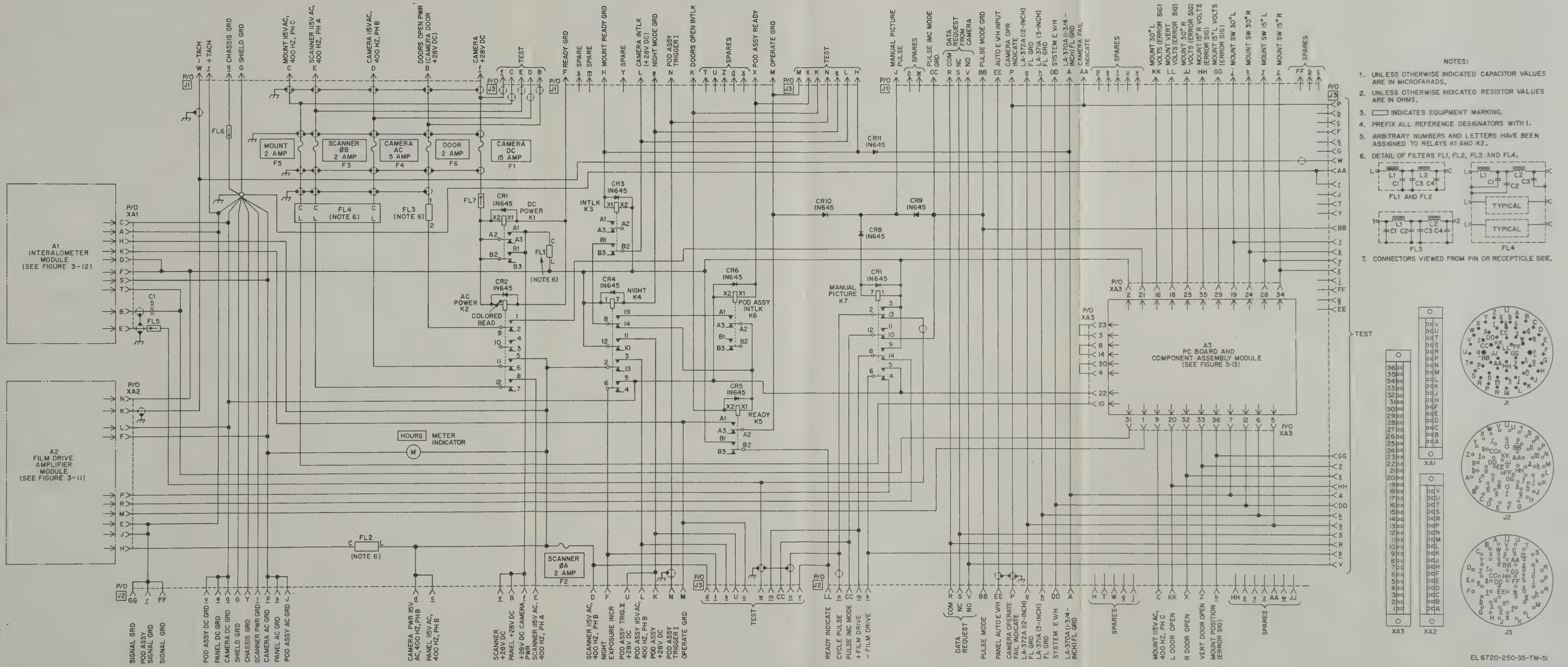
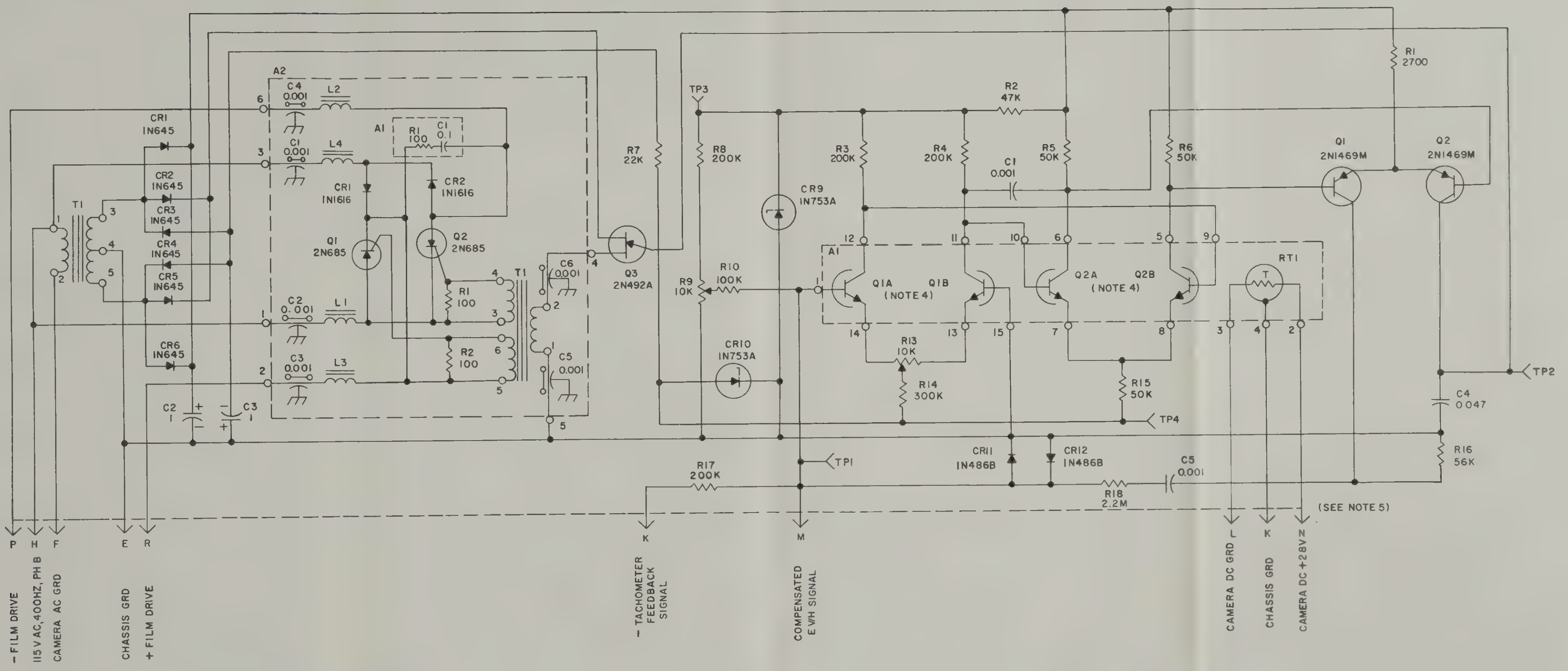


Figure 3-10. Photo system assembly, schematic diagram.

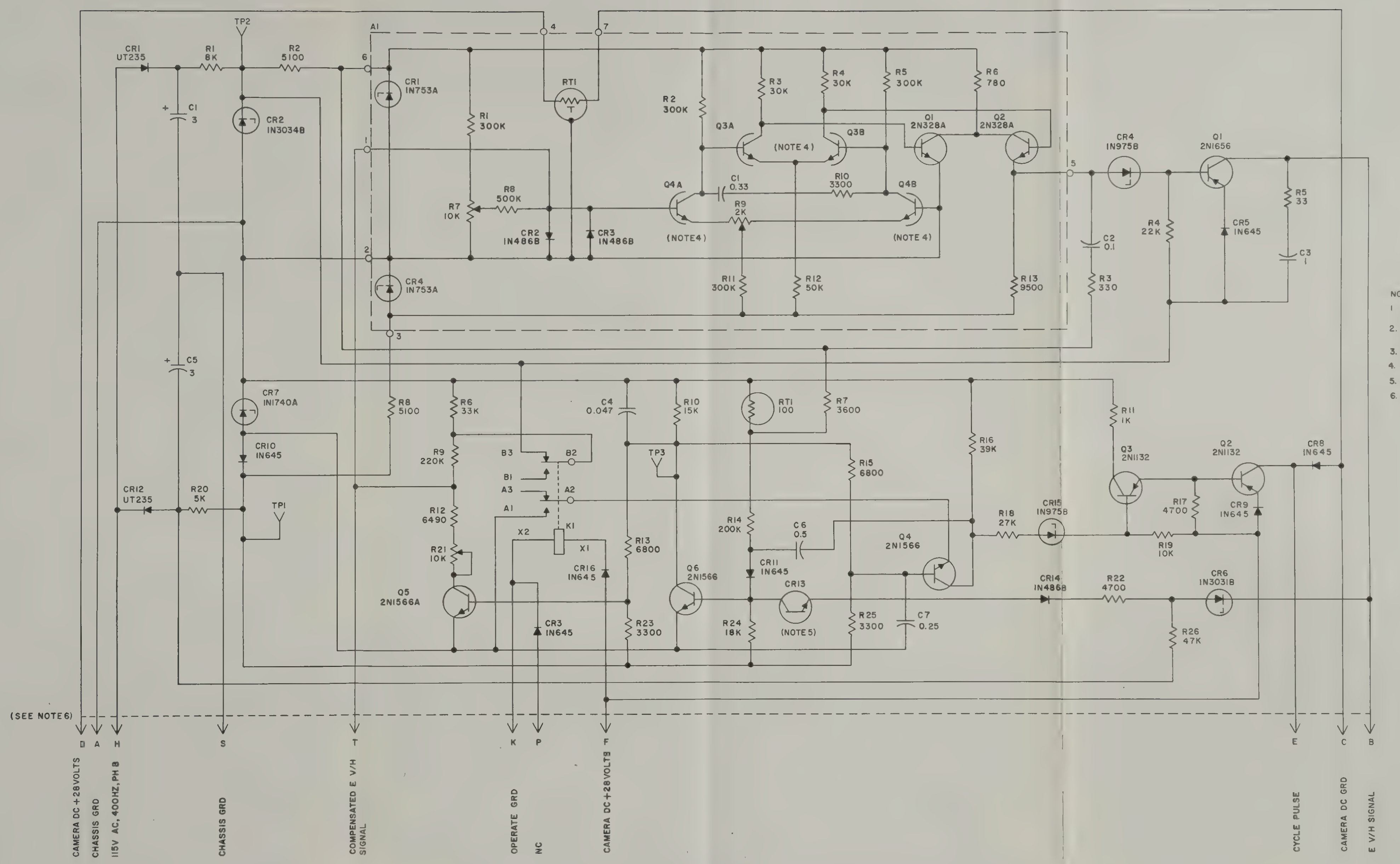


NOTES:

1. UNLESS OTHERWISE INDICATED CAPACITOR VALUES ARE IN MICROFARADS.
2. UNLESS OTHERWISE INDICATED RESISTOR VALUES ARE IN OHMS.
3. PREFIX ALL REFERENCE DESIGNATORS WITH 1A2.
4. NPN MATCHED PAIR TRANSISTORS PN6052-136 (11871)
5. PINS ARE AN INTEGRAL PART OF FILM DRIVE AMPLIFIER MODULE PRINTED CIRCUIT BOARD.

EL6720-250-35-TM-109

Figure 3-11. Film drive amplifier module 1A2, schematic diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED CAPACITOR VALUES ARE IN MICROFARADS.
2. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS.
3. PREFIX ALL REFERENCE DESIGNATORS WITH 1A1.
4. NPN MATCHED PAIR TRANSISTORS-PN 6052-136 (11871)
5. PN 6055-171-1 (11871).
6. PINS ARE INTEGRAL PART OF INTERVALOMETER MODULE PRINTED CIRCUIT BOARD.

EL6720-250-35-TM-110

Figure 3-12. Intervalometer module 1A1, schematic diagram.

NOTES:

1. UNLESS OTHERWISE INDICATED CAPACITOR VALUES ARE IN MICROFARADS.
2. UNLESS OTHERWISE INDICATED RESISTOR VALUES ARE IN OHMS.
3. PREFIX ALL REFERENCE DESIGNATORS WITH 1A3.
4. PINS ARE AN INTEGRAL PART OF PRINTED CIRCUIT BOARD.
5. PINS 3 AND 23 ARE CONNECTED TOGETHER EXTERNALLY.
6. PINS 4 AND 30 ARE CONNECTED TOGETHER EXTERNALLY.
7. PINS 8 AND 14 ARE CONNECTED TOGETHER EXTERNALLY.

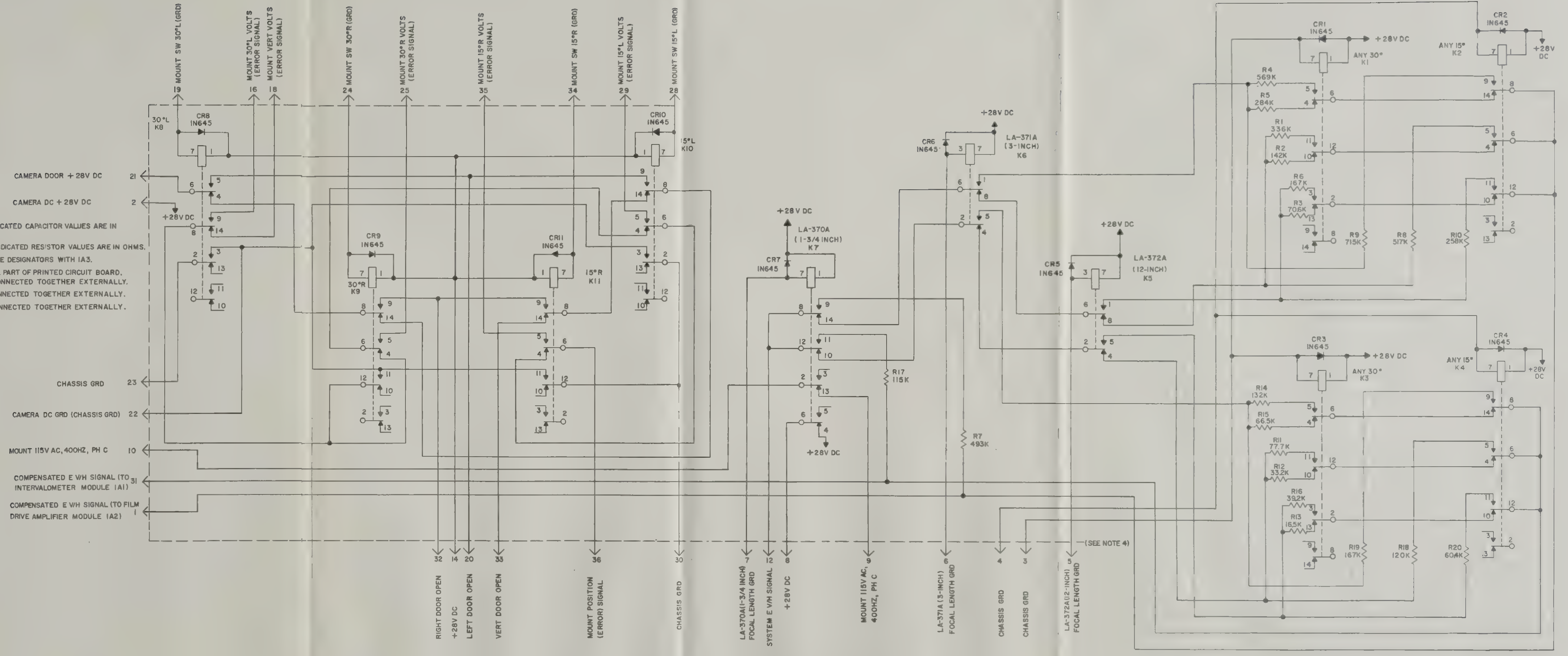
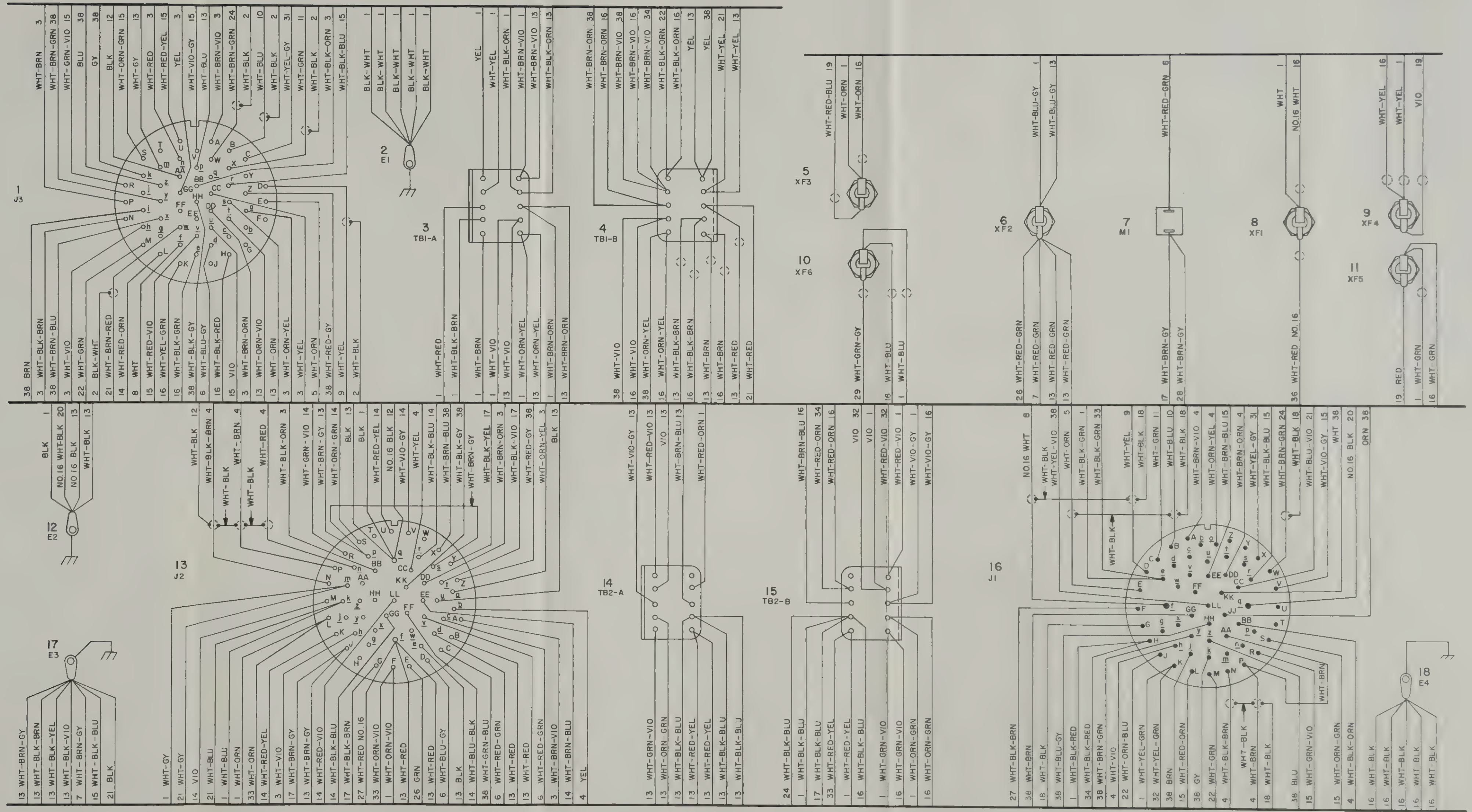


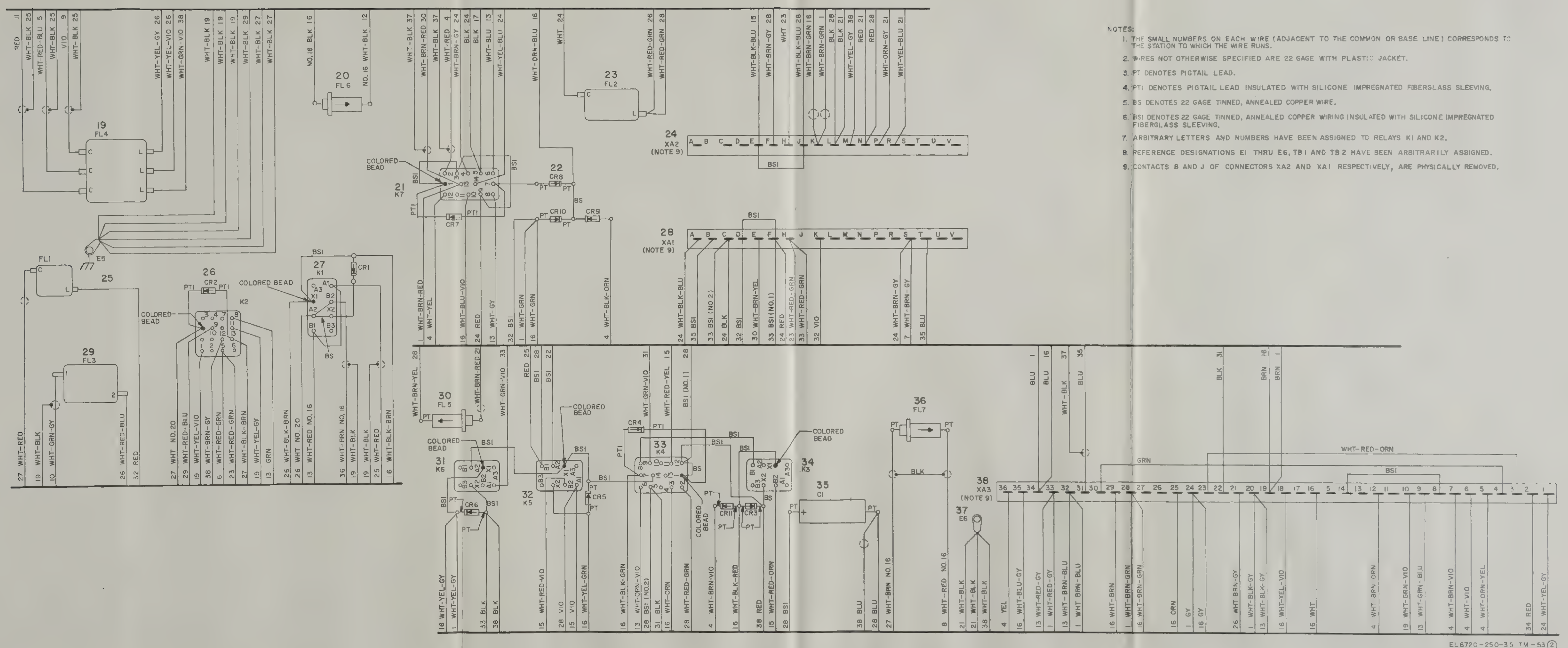
Figure 3-13. PC board and component assembly module 1A3, schematic diagram.

EL6720-250-35-TM-111



EL6720-250-35-TM-53(1)

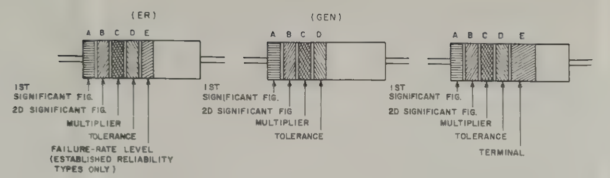
Figure 3-14(1). Photo system assembly, wiring diagram (sheet 1 of 2).



NOTES:

1. THE SMALL NUMBERS ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE STATION TO WHICH THE WIRE RUNS.
2. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH PLASTIC JACKET.
3. PT DENOTES PIGTAIL LEAD.
4. PTI DENOTES PIGTAIL LEAD INSULATED WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.
5. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRE.
6. BSI DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRING INSULATED WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.
7. ARBITRARY LETTERS AND NUMBERS HAVE BEEN ASSIGNED TO RELAYS K1 AND K2.
8. REFERENCE DESIGNATIONS E1 THRU E6, TB1 AND TB2 HAVE BEEN ARBITRARILY ASSIGNED.
9. CONTACTS B AND J OF CONNECTORS XA2 AND XA1 RESPECTIVELY, ARE PHYSICALLY REMOVED.

Figure 5-14(2). Photo system assembly, wiring diagram (sheet 2 of 2).



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE 1
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E		
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM
BLACK	0	BLACK	0	BLACK	1			BROWN	M	
BROWN	1	BROWN	1	BROWN	10			RED	P	
RED	2	RED	2	RED	100			ORANGE	R	
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S	
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE	....	SOLDERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY).			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7							
GRAY	8	GRAY	8	SILVER	1.01					
WHITE	9	WHITE	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL. ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

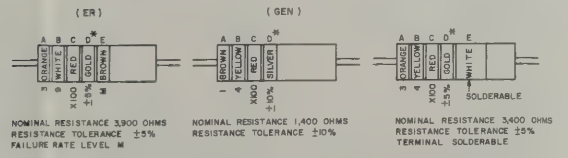
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODED.)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS   10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

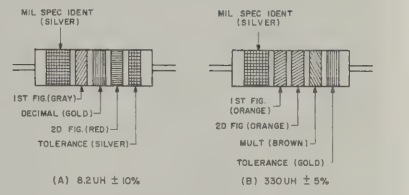
NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS   FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.



COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED.

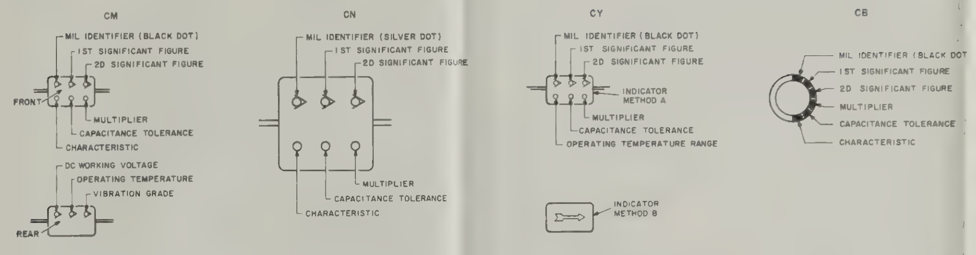
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

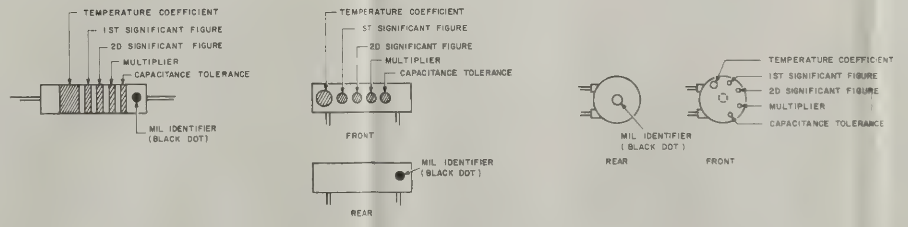
MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB.



MICA-DIELECTRIC   PAPER-DIELECTRIC   GLASS-DIELECTRIC, GLASS CASE   MICA, BUTTON TYPE



AXIAL LEAD   RADIAL LEAD   DISK-TYPE

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB

COLOR	MIL ID	1ST SIG FIG	2D SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CM
BLACK	CM CY CB	0	0				±20%	±20%		A			-55° TO +70°C	10-55 HZ
BROWN				[illegible]					B	E	B			
RED		2	2	[illegible]	±2%		±2%	±2%	C				-55° TO +85°C	
ORANGE		3	3	[illegible]		±30%			[illegible]		D	300		
YELLOW		4	4	10,000					E				-55° TO +125°C	10-2,000HZ
GREEN		5	5		±5%				F			500		
BLUE		6	6										-55° TO +150°C	
PURPLE (VIOLET)		7	7											
GREY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN				±10%	±10%	±10%	±10%						

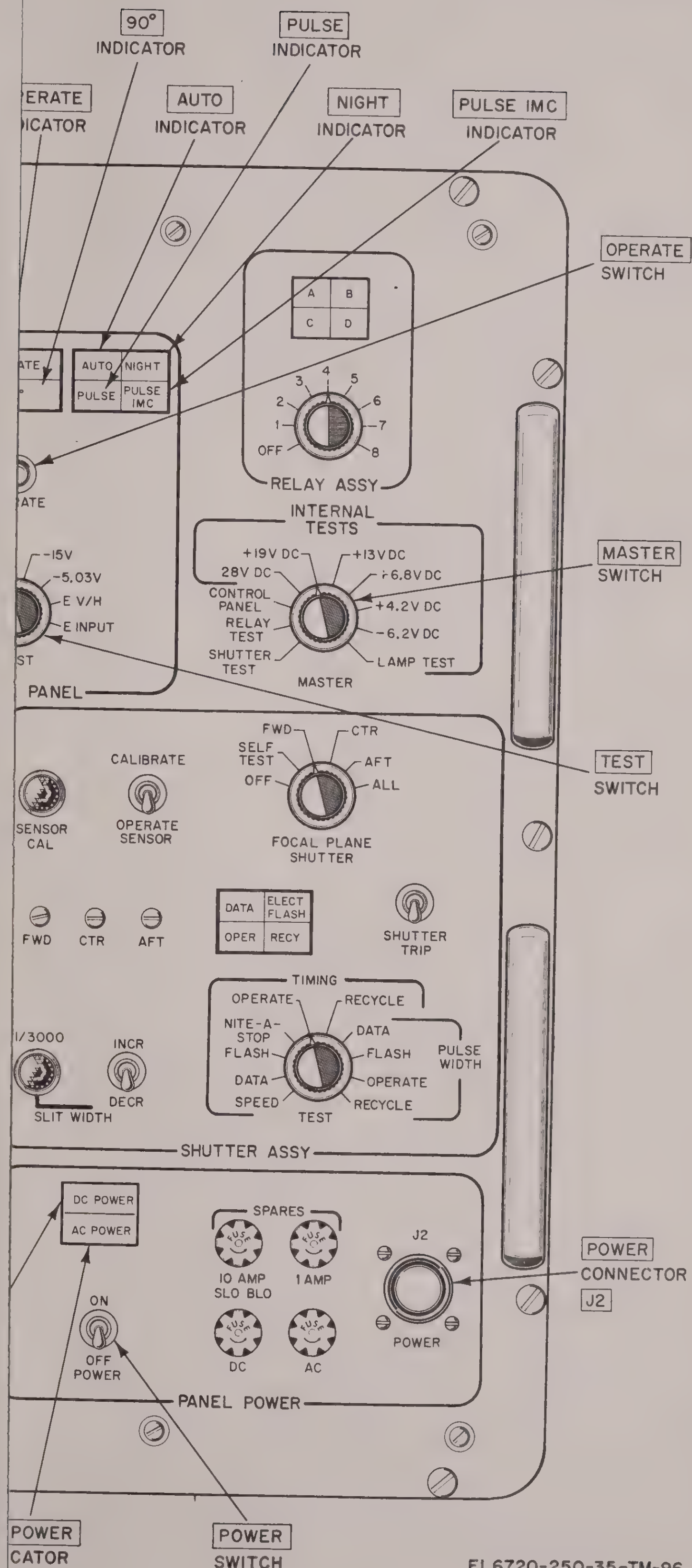
TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0			±2.0 UUF	CC
BROWN	-30			[illegible]	±1%		
RED	-80	2	2	100	±2%	±0.25 UUF	
ORANGE	-150	3	3	1,000			
YELLOW	-220	4	4				
GREEN	-330	5	5		±5%	±0.5 UUF	
BLUE	-470	6	6				
PURPLE (VIOLET)	-750	7	7				
GREY		8	8	[illegible]			
WHITE		9	9	[illegible]	±10%		
GOLD	+100					±1.0 UUF	
SILVER							

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
2. LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-25D, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.
3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.
4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

Figure 5-8. Color code markings for MIL-STD resistors, inductors, and capacitors.



s, and connectors.

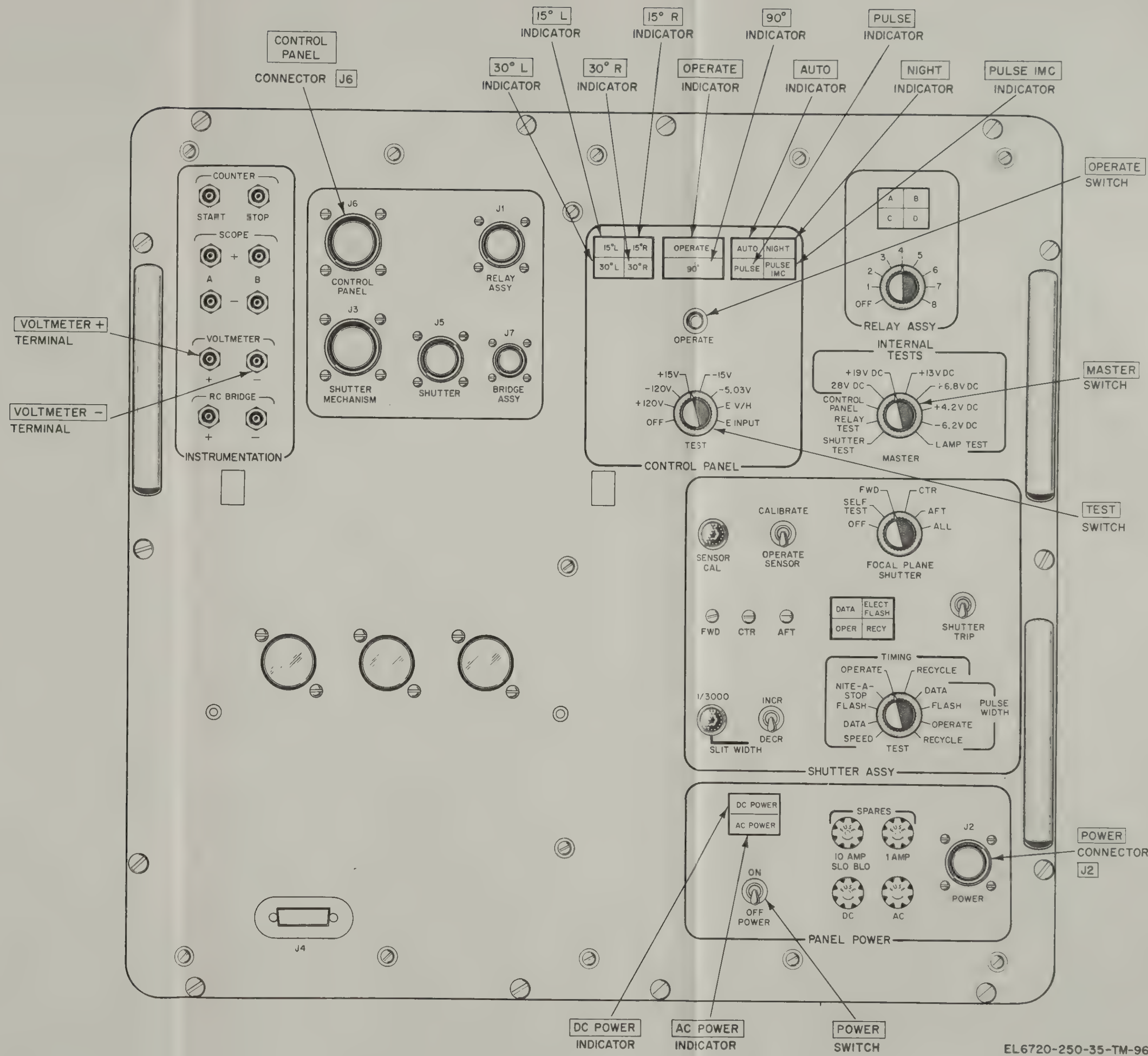
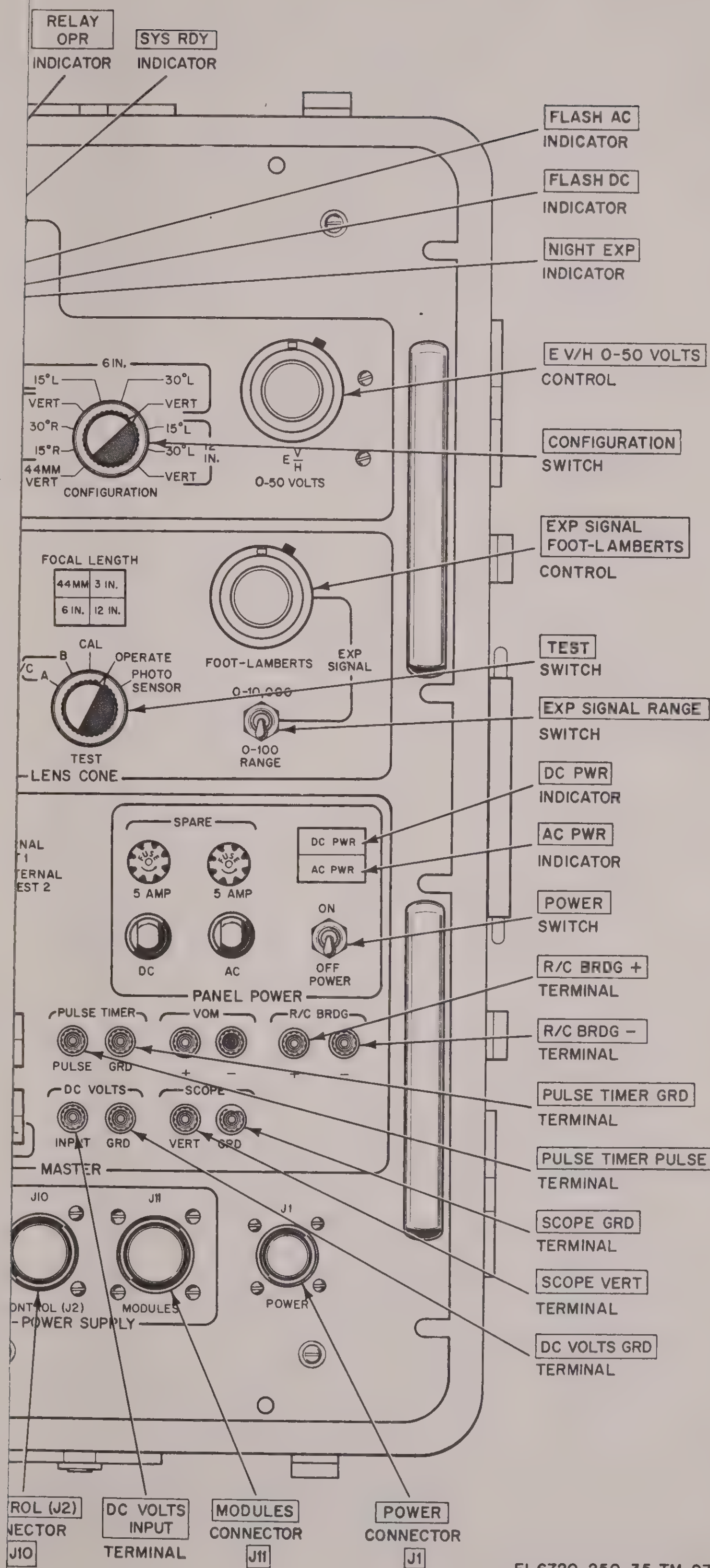


Figure 5-11. LS-78A controls, indicators, and connectors.



tors, and connectors.

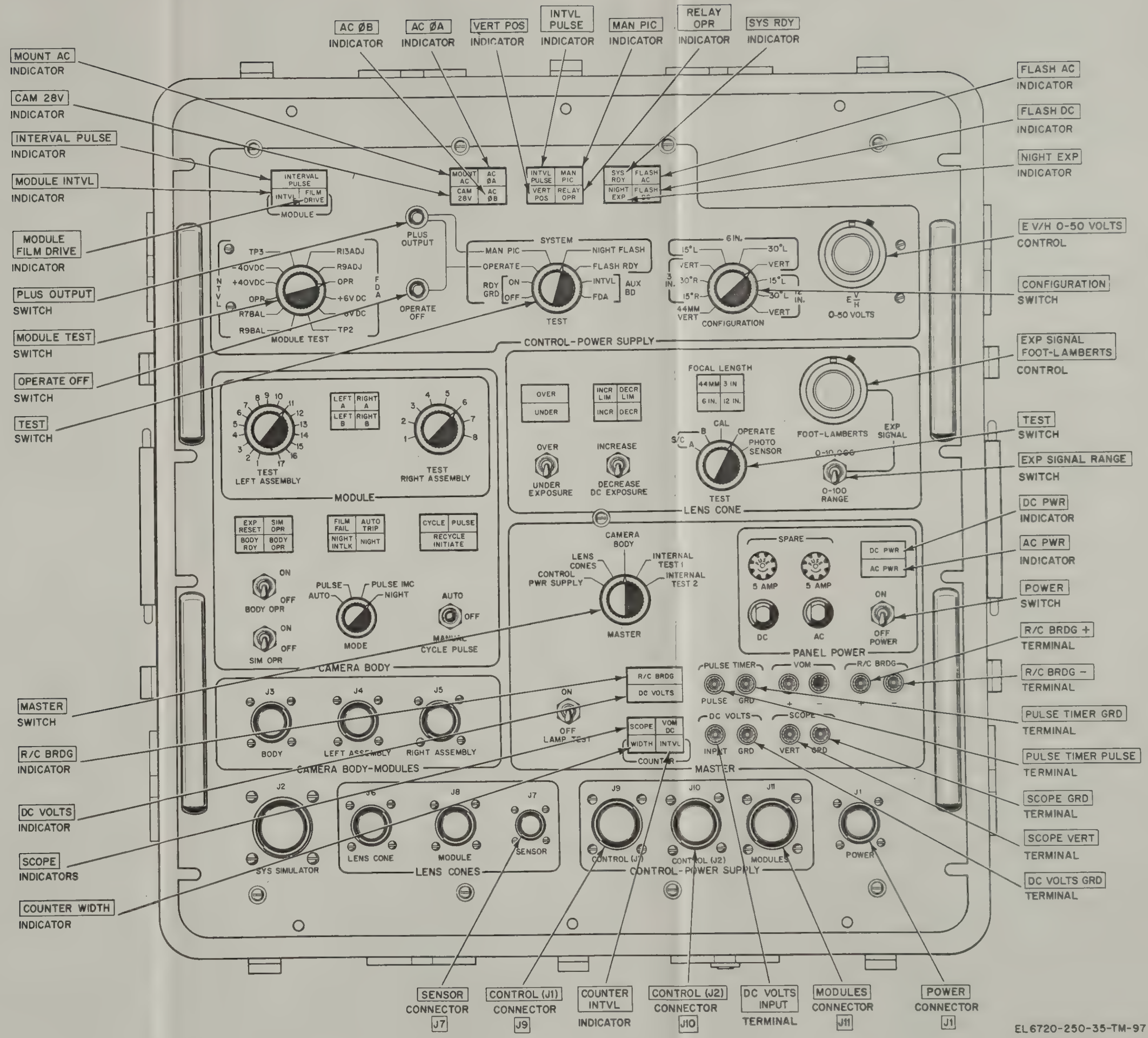
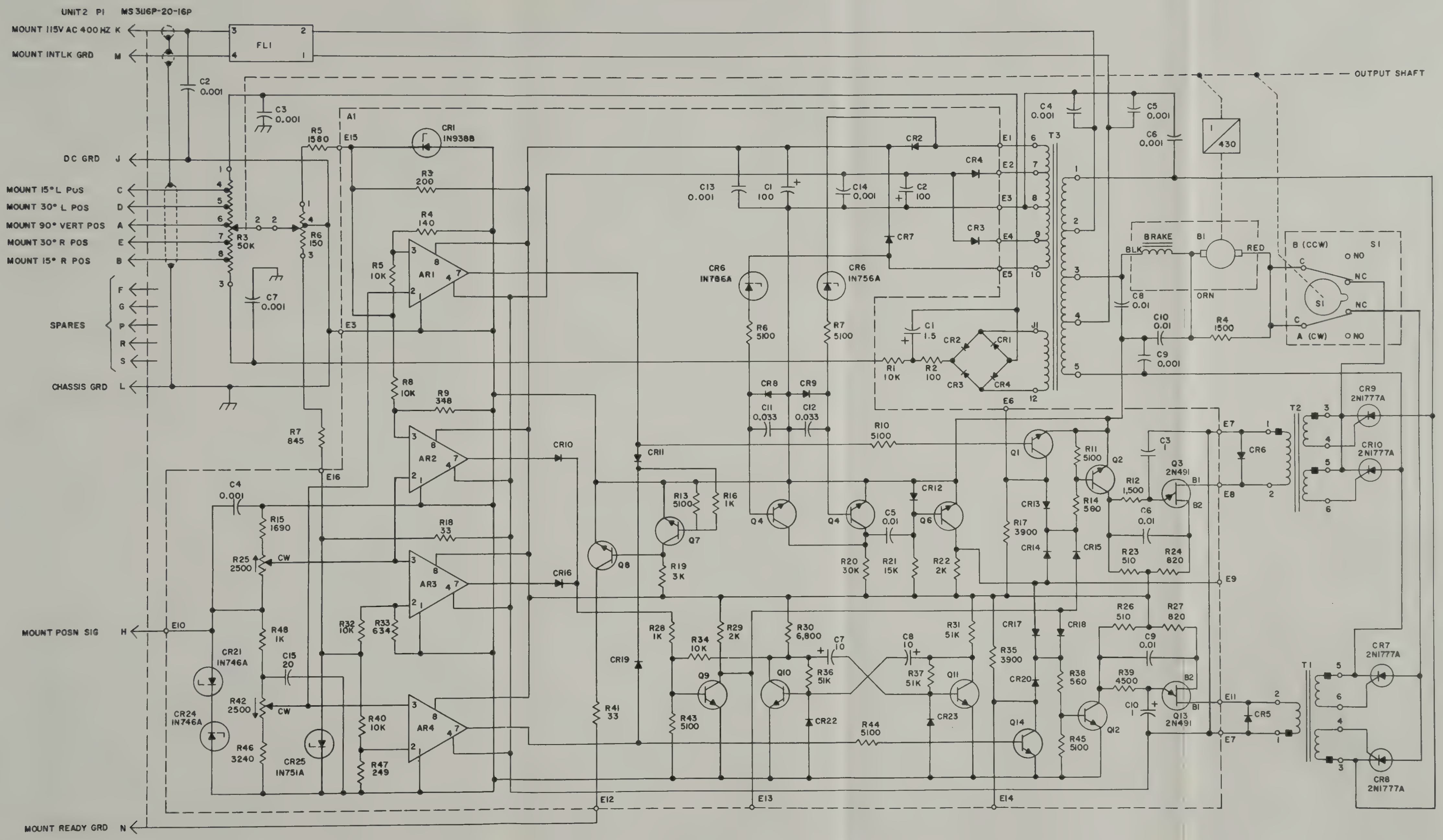
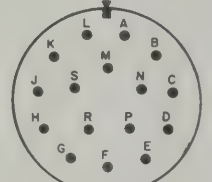


Figure 5-13. LS-80A controls, indicators, and connectors.



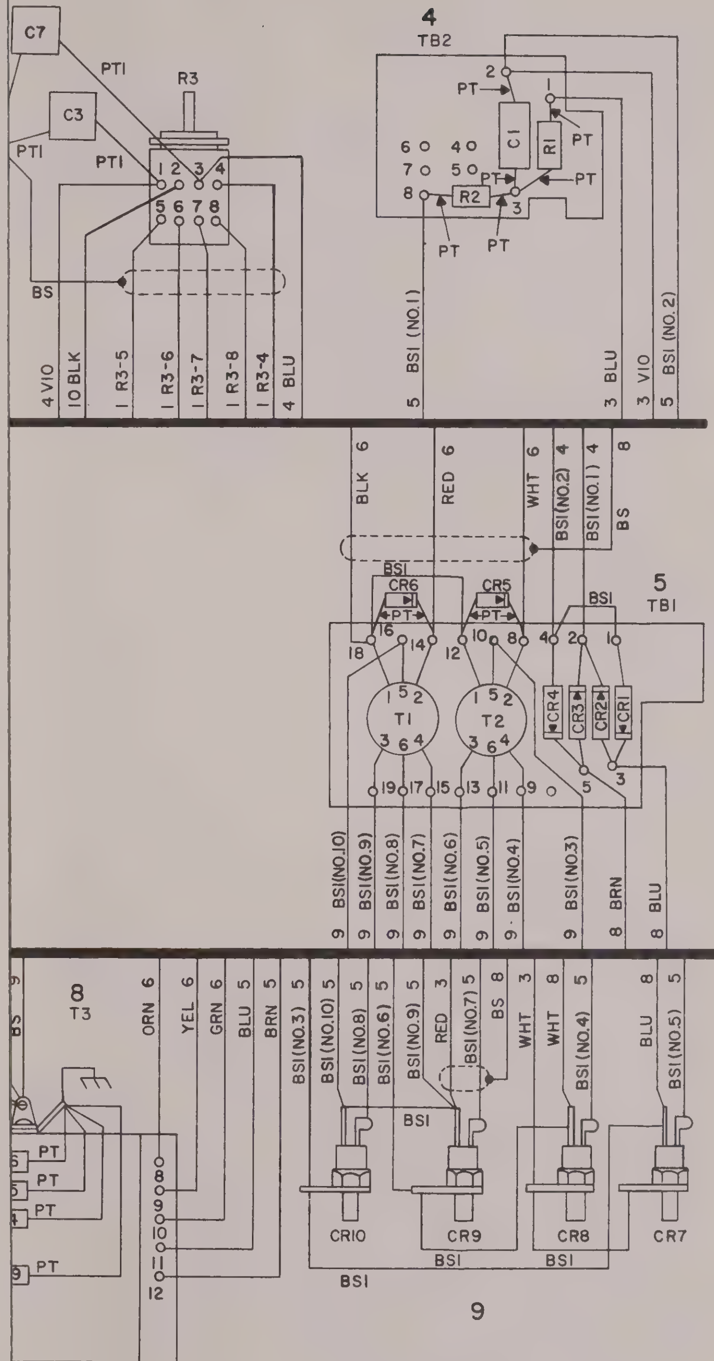


NOTES:

1. UNLESS OTHERWISE INDICATED; RESISTORS ARE IN OHMS, CAPACITANCES ARE IN UF, TRANSISTORS ARE 2N657 AND DIODES ARE IN645.
2. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO. 2 (2).
3. CONNECTOR VIEWED FROM PIN SIDE.

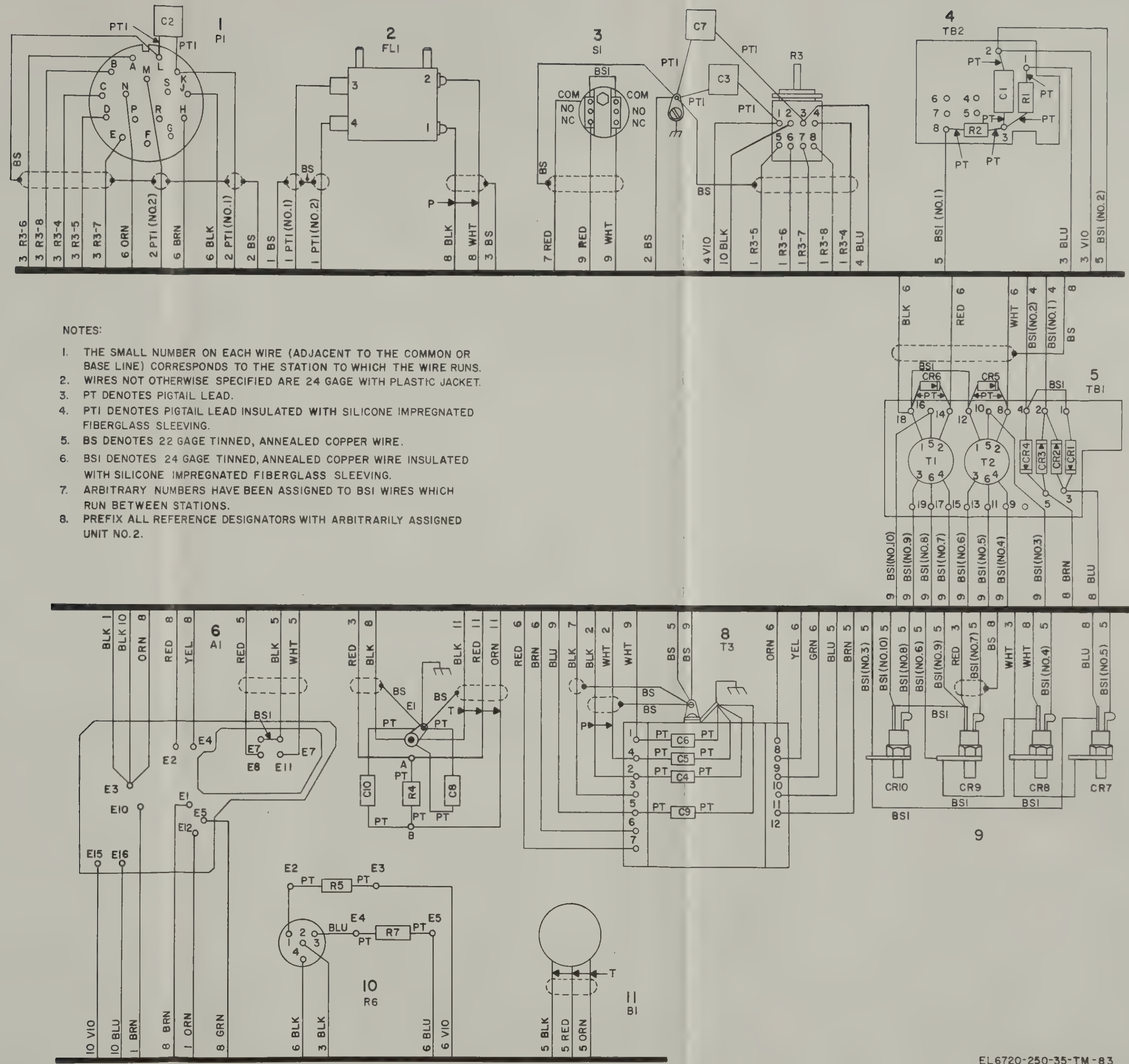
EL6720-250-35-TM-81

Figure 5-22. Rotary mount actuator, schematic diagram.



EL6720-250-35-TM-83

wiring diagram.



NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE STATION TO WHICH THE WIRE RUNS.
2. WIRES NOT OTHERWISE SPECIFIED ARE 24 GAGE WITH PLASTIC JACKET.
3. PT DENOTES PIGTAIL LEAD.
4. PT1 DENOTES PIGTAIL LEAD INSULATED WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.
5. BS DENOTES 22 GAGE TINNED, ANNEALED COPPER WIRE.
6. BS1 DENOTES 24 GAGE TINNED, ANNEALED COPPER WIRE INSULATED WITH SILICONE IMPREGNATED FIBERGLASS SLEEVING.
7. ARBITRARY NUMBERS HAVE BEEN ASSIGNED TO BS1 WIRES WHICH RUN BETWEEN STATIONS.
8. PREFIX ALL REFERENCE DESIGNATORS WITH ARBITRARILY ASSIGNED UNIT NO.2.

Figure 5-23. Rotary mount actuator, wiring diagram.

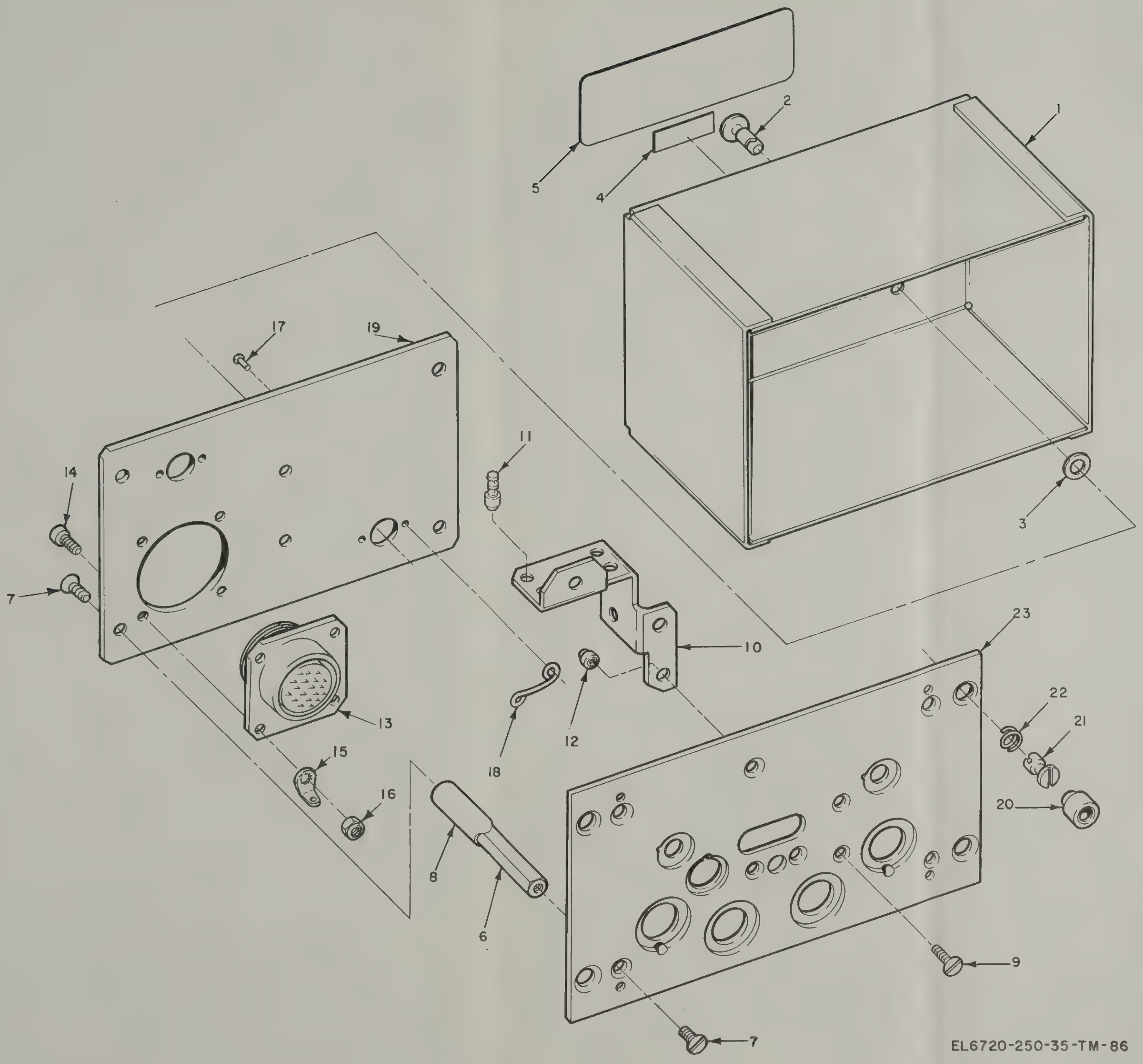


Figure 5-36. Photo control panel, exploded view.

Note. Prefix all reference designations for photo control panel with 3.

1 Cover (1)
2 Captive fastener (2)
3 Grommet (2)
4 Plate (1)
5 Plate (1)
6 Spacer (4)
7 Screw (8)
8 Tubing (4)
9 Screw (3)
10 Bracket and component assembly (1)
11 Terminal (1)
12 Nut (3)
13 Connector (J1) (1)
14 Screw (4)
15 Terminal (1)
16 Nut (4)
17 Rivet (4)
18 Spring (2)
19 Rear plate (1)
20 Cup (4)
21 Stud (4)
22 Spring (4)
23 Front plate (1)

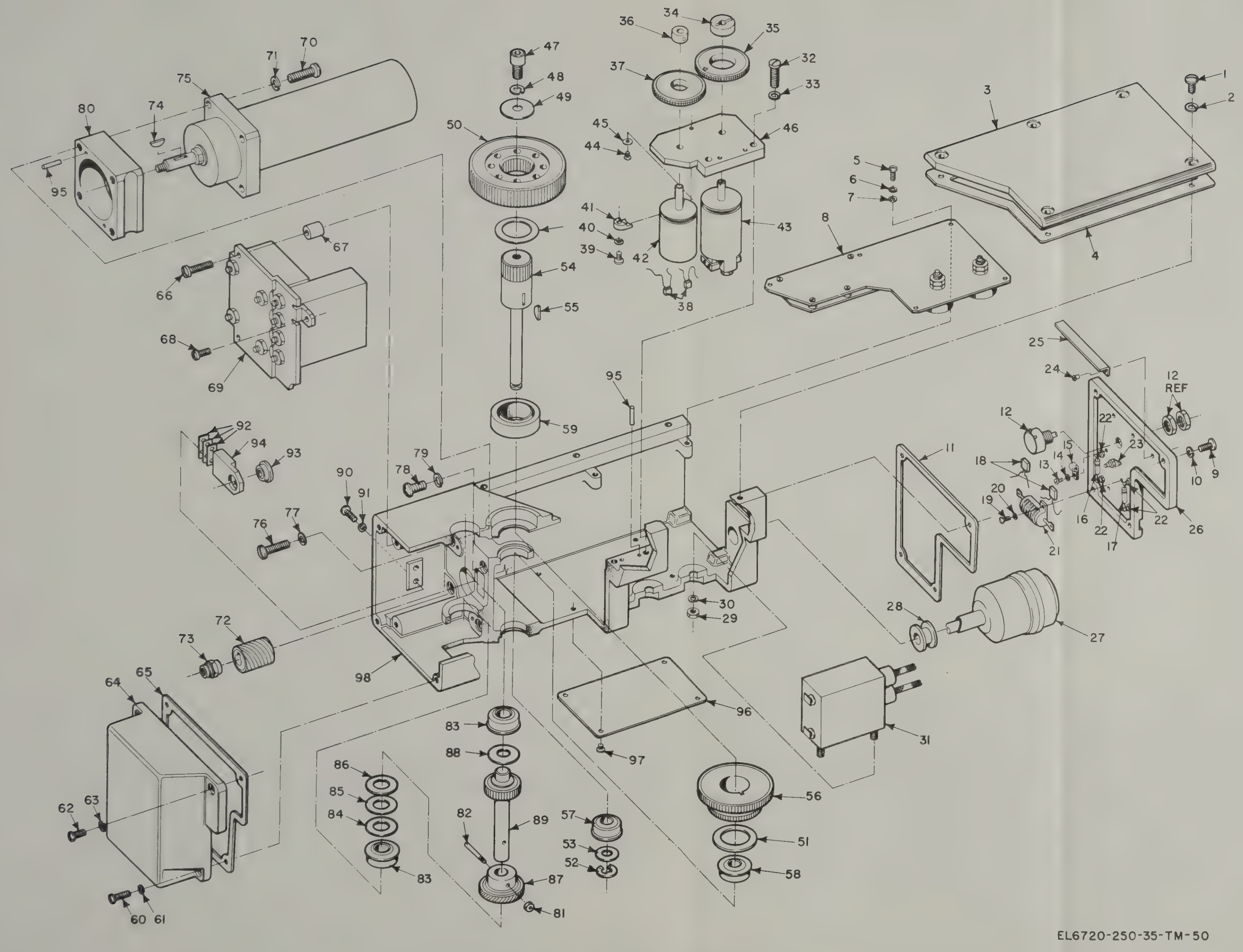


Figure 5-42. Rotary mount actuator, exploded view.

Note. Prefix all reference designations for rotary mount actuator with 2.

1 Screw (5)
2 Washer (5)
3 Top cover (1)
4 Top cover gasket (1)
5 Screw (5)
6 Washer (5)
7 Washer (5)
8 Electronic circuit assembly (A1) (1)
9 Screw (4)
10 Washers (4)
11 End cover gasket (1)
12 Index potentiometer (R6) (1) (nuts supplied with pot)
13 Screw (1)
14 Washer (1)
15 Cable clamp (1)
16 Resistor (R5) (1)
17 Resistor (R7) (1)
18 Capacitor (C8, C10) (2)
19 Screw (1)
20 Washer (1)
21 Resistor (R4) (1)
22 Threaded insulated terminals (E1 through E5) (5)
23 Ground lug (1)
24 Rivet (3)
25 Support bracket (1)
26 End cover (1)
27 Connector (P1) (1)
28 Grommet (1)
29 Nut (2)
30 Washer (2)
31 Filter (FL1) (1)
32 Screw (2)
33 Washer (2)
34 Gear clamp (1)
35 Antibacklash gear assembly (1)
36 Gear clamp (1)
37 Antibacklash gear assembly (1)
38 Capacitor (C3, C7) (2)
39 Screw (6)
40 Washer (6)
41 Clamp (6)
42 Followup potentiometer (R3) (1)
43 Limit switch (S1) (1)
44 Screw (1)
45 Terminal lug (1)
46 Mounting plate (1)
47 Screw (1)
48 Washer (1)
49 Washer (1)
50 Pinion gear (1)
51 Washer (2)
52 Retaining ring (1)
53 Washer (1)
54 Spline shaft (1)
55 Key (1)
56 Cluster gear (1)
57 Gearing (1)
58 Bearing (1)
59 Bearing (1)
60 Screws (3)
61 Washers (3)
62 Screw (1)
63 Washer (1)
64 End cover (1)
65 End cover gasket (1)
66 Screws (2)
67 Bushing (2)
68 Screw (1)
69 Power assembly (1)
70 Screw (4)
71 Washer (4)
72 Bearing nut (1)
73 Worm gear (1)
74 Key (1)
75 Dc motor (B1) (1)
76 Screw (3)
77 Washer (3)
78 Screw (1)
79 Washer (1)
80 Motor mounting block (1)
81 Nut (1)
82 Taper pin (1)
83 Bearing (2)
84 Washer (1)
85 Washer (1)
86 Washer (1)
87 Worm gear (1)
88 Washer (1)
89 Gear shaft (1)
90 Screw (2)
91 Washer (2)
92 Shim (AR)
93 Bearing (1)
94 Bearing block (1)
95 Pin (4)
96 Screw (4)
97 Nameplate (1)
98 Housing (1)

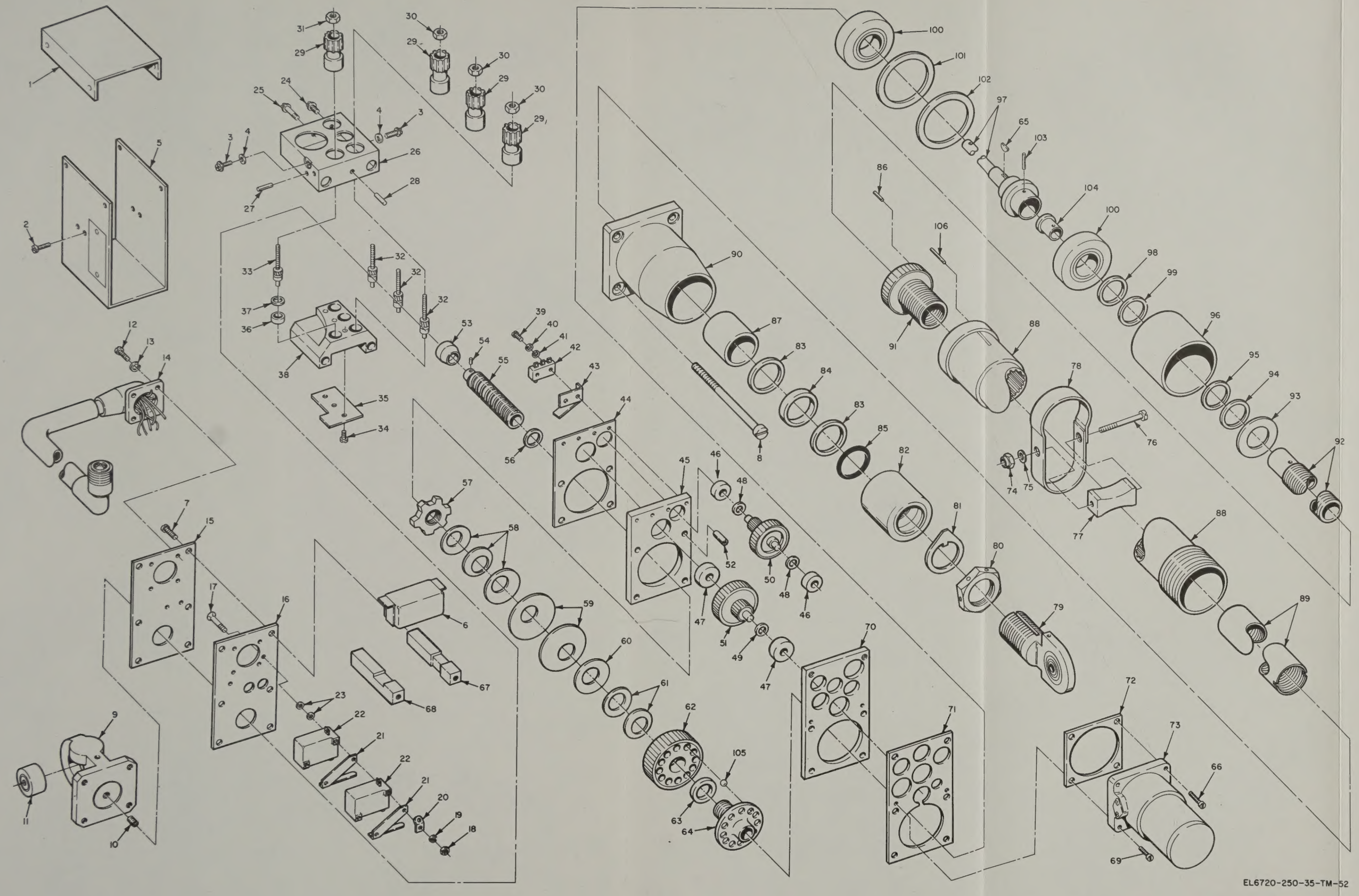


Figure 5-46. Door actuator, exploded view.

Note. Prefix all reference designations for door actuator with 4.

1 Snap cover (1)
2 Screw (2)
3 Screw (2)
4 Ring (2)
5 Cover (1)
6 Filter (FL1) (1)
7 Screw (4)
8 Screw (4)
9 End fitting (1)
10 Setscrew (1)
11 Radial bearing (1)
12 Screw (4)
13 Washer (4)
14 Junction box (1)
15 Retaining plate (1)
16 Switchplate (1)
17 Screw (2)
18 Nut (2)
19 Washer (2)
20 Terminal (1)
21 Contact (2)
22 Switch (S1, S2) (2)
23 Spacer (4)
24 Screw (1)
25 Screw (1)
26 Support block (1)
27 Rod (1)
28 Rod (1)
29 Guide (4)
30 Traveler (3)
31 Traveler (1)
32 Traveler screw (3)
33 Traveler screw (1)
34 Screw (3)
35 Plate (1)
36 Spacer (4)
37 Shim (AR)
38 Support block (1)
39 Screw (2)
40 Washer (2)
41 Washer (2)
42 Switch (S3) (1)
43 Contact (1)
44 Retaining plate (1)
45 Support plate (1)
46 Ball bearing (2)
47 Ball bearing (2)
48 Shim washer (2)
49 Shim washer (1)
50 Spur gear (1)
51 Spur gear (1)
52 Spacers (4)
53 Bushing (1)
54 Dowel pin (1)
55 Helical gear (1)
56 Shim (AR)
57 Retainer nut (1)
58 Washer assembly (1)
59 Spring washer (2)
60 Spring washer (1)
61 Spring washer (2)
62 Spur gear (1)
63 Shim (1)
64 Flange clutch (1)
65 Woodruff key (1)
66 Screw (2)
67 Spacer (1)
68 Spacer (1)
69 Screw (2)
70 Support plate (1)
71 Retaining plate (1)
72 Cover plate (1)
73 Motor (B1) (1)
74 Nut (1)
75 Washer (1)
76 Screw (1)
77 Support block (1)
78 Clamp (1)
79 Fitting assembly (1)
80 Nut (1)
81 Tab washer (1)
82 Stop nut (1)
83 Washer (2)
84 Spacer (1)
85 Packing ring (1)
86 Pin (1)
87 Sleeve spacer (1)
88 Guide housing (1)
89 Nut tube (1)
90 Guide flange (1)
91 Acme nut (1)
92 Acme screw (1)
93 Stop washer (1)
94 Shim (1)
95 Shim (1)
96 Sleeve spacer (1)
97 Bearing shaft (1)
98 Shim (1)
99 Shim (1)
100 Ball bearing (2)
101 Thrust washer (1)
102 Shim (1)
103 Pin (1)
104 Plug (1)
105 Steel ball bearing (12)
106 Pin (1)

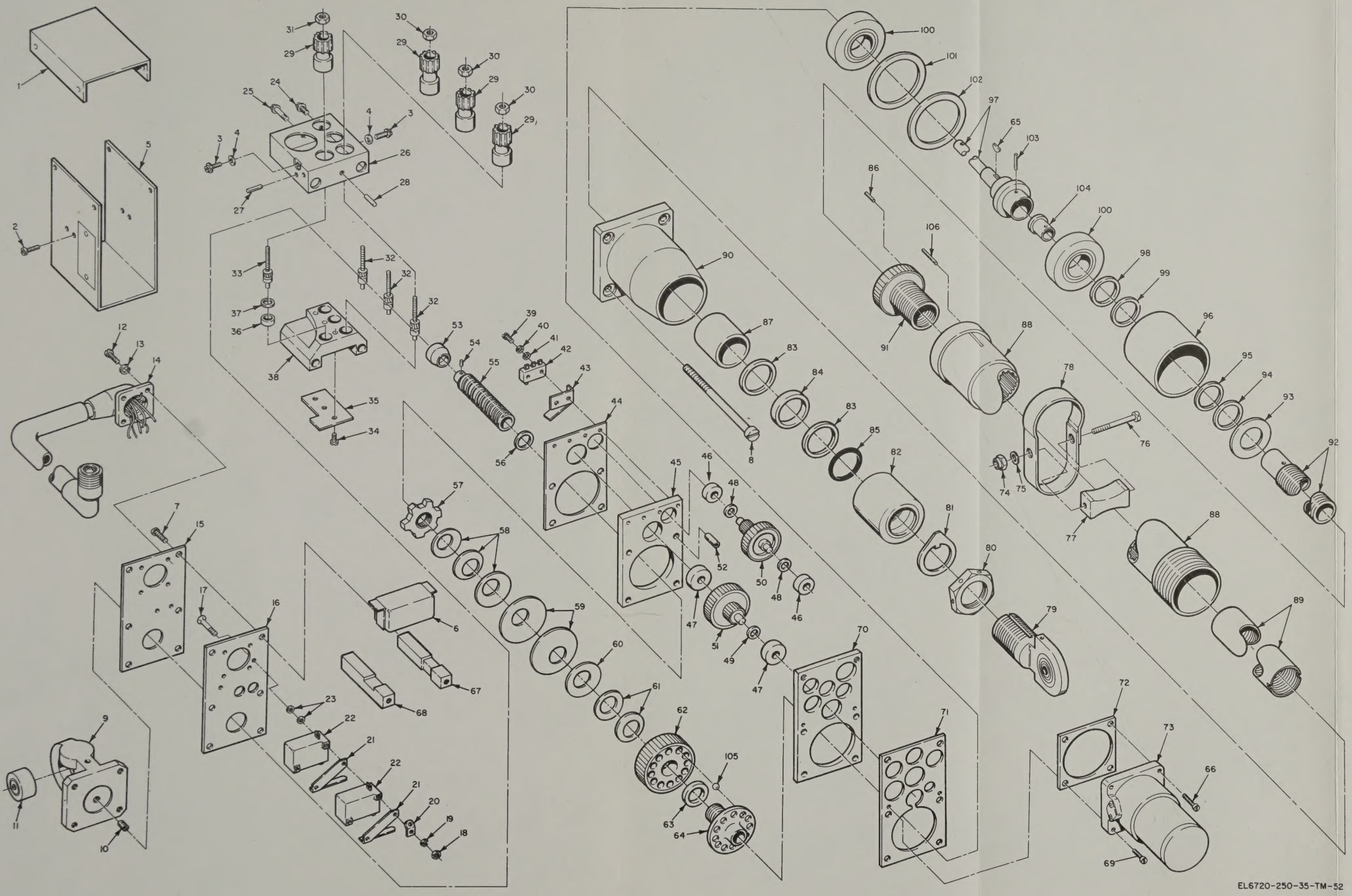


Figure 5-46. Door actuator, exploded view.

Note. Prefix all reference designations for door actuator with 4.

1 Snap cover (1)
2 Screw (2)
3 Screw (2)
4 Ring (2)
5 Cover (1)
6 Filter (FL1) (1)
7 Screw (4)
8 Screw (4)
9 End fitting (1)
10 Setscrew (1)
11 Radial bearing (1)
12 Screw (4)
13 Washer (4)
14 Junction box (1)
15 Retaining plate (1)
16 Switchplate (1)
17 Screw (2)
18 Nut (2)
19 Washer (2)
20 Terminal (1)
21 Contact (2)
22 Switch (S1, S2) (2)
23 Spacer (4)
24 Screw (1)
25 Screw (1)
26 Support block (1)
27 Rod (1)
28 Rod (1)
29 Guide (4)
30 Traveler (3)
31 Traveler (1)
32 Traveler screw (3)
33 Traveler screw (1)
34 Screw (3)
35 Plate (1)
36 Spacer (4)
37 Shim (AR)
38 Support block (1)
39 Screw (2)
40 Washer (2)
41 Washer (2)
42 Switch (S3) (1)
43 Contact (1)
44 Retaining plate (1)
45 Support plate (1)
46 Ball bearing (2)
47 Ball bearing (2)
48 Shim washer (2)
49 Shim washer (1)
50 Spur gear (1)
51 Spur gear (1)
52 Spacers (4)
53 Bushing (1)
54 Dowel pin (1)
55 Helical gear (1)
56 Shim (AR)
57 Retainer nut (1)
58 Washer assembly (1)
59 Spring washer (2)
60 Spring washer (1)
61 Spring washer (2)
62 Spur gear (1)
63 Shim (1)
64 Flange clutch (1)
65 Woodruff key (1)
66 Screw (2)
67 Spacer (1)
68 Spacer (1)
69 Screw (2)
70 Support plate (1)
71 Retaining plate (1)
72 Cover plate (1)
73 Motor (B1) (1)
74 Nut (1)
75 Washer (1)
76 Screw (1)
77 Support block (1)
78 Clamp (1)
79 Fitting assembly (1)
80 Nut (1)
81 Tab washer (1)
82 Stop nut (1)
83 Washer (2)
84 Spacer (1)
85 Packing ring (1)
86 Pin (1)
87 Sleeve spacer (1)
88 Guide housing (1)
89 Nut tube (1)
90 Guide flange (1)
91 Acme nut (1)
92 Acme screw (1)
93 Stop washer (1)
94 Shim (1)
95 Shim (1)
96 Sleeve spacer (1)
97 Retaining shaft (1)
98 Shim (1)
99 Shim (1)
100 Ball bearing (2)
101 Thrust washer (1)
102 Shim (1)
103 Pin (1)
104 Plug (1)
105 Steel ball bearing (12)
106 Pin (1)